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JOURNAL OF THE PROCEEDINGS

OF THE

LINNEAN SOCIETY OF LONDON.

Contributions to the Cryptogamic Flora of the Atlantic Islands. By William Mitten, A.L.S.

[Read Nov. 5, 1863.]

[Plates I. & II.]

The Moss-Flora of the Azores, the Canaries, and Madeira, so far as it is possible to judge from the small collection from the Azores given by Mr. H. C. Watson, the enumeration of those from the Canaries by Dr. Montagne in Webb and Berthelot's 'Hist. des Iles Canaries,' and the collections brought home year by year by Mr. J. Y. Johnson on his return from his winter residence in Madeira, would appear to be very nearly identical. Nearly all the species enumerated from the Canaries have already been detected in Madeira; but, even when allowance is made for the position of the Flora as belonging to the Mediterranean region, there still remain a number of species attributed to that Flora which ought to occur in Madeira. Besides the presence of a few species so far as yet known peculiar to the Atlantic Islands, as *Astrodontium Canariense* and *Neckera intermedia*, Brid., their Flora contains some other species which, although hitherto known to occur in very few places in Europe, may be expected to be found on the south or western coasts of the British Islands. That this supposition is not unreasonable is proved by the finding of *Myurium Hebridarum*, Schimp., a moss common to the Azores and Madeira, in the Hebrides. Amongst the specimens obtained by Mr. Johnson in Madeira are three remarkable species, supposed, in the accompanying descriptions, to belong to the Leskeoid mosses; of these

only one has as yet been met with in fruit; but the presence of these three closely allied species in such a circumscribed area is interesting, for it is only in Australia, Tasmania, and New Zealand that two certainly congeneric species are known to exist. To these are added descriptions of a few other curious species, chiefly from Madeira.

MUSCI.

ANŒCTANGIUM, *Schw.*

A. ANGUSTIFOLIUM, sp. nov. Caule brevi gracili, foliis patentibus linearibus basi paululo angustioribus concavis apice acutis nervo percurrente, cellulis basi paucis quadratis pellucidis sensim in minutas rotundatas subleves transeuntibus, perichætialibus ovato-lanceolatis, theca in pedunculo gracili obovata.

Hab. Teneriffe, "ad rupes sylvarum," *Schmidt in Herb. Hooker.* no. 46.

Less than *A. compactum*, Schl., and softer. The leaves are about ten times as long as broad, pale green, subcrispate when dry; the cells very minute, but distinct.

A. compactum occurs in Teneriffe and Madeira, and grows associated with *Zygodon curvipes*, C. Müller, a moss which is found also on the mountains of Abyssinia and does not appear to differ from *Z. cyathicarpus*, Mont., so widely distributed in the southern hemisphere.

GLYPHOMITRIUM, *Brid.*

(*Ptychomitrium*, Schimp.)

G. PULVINARE, sp. nov. Monoicum, pulvinatum, foliis patentibus incurvis e basi subovata lanceolatis acutis nervo excurrente marginibus integerrimis, cellulis basi paucis quadratis rectangulatis cito in parvas rotundatas approximatas transeuntibus diametro circiter $\frac{1}{2000}$ unciæ metientibus, perichætialibus conformibus, theca in pedunculo trilineari obovata, operculo rostro theca dimidio breviore, peristomio dentibus brevibus solidis.

Hab. Madeira, on rocks, *Johnson.*

Growing in small hemispherical tufts of a dull dark green colour, much resembling *G. crispatum*, Bridel = *Grimmia crispata*, Hook., but with leaves having the cells of the upper portion much larger and those of the base not elongated. *G. polyphyllum*, Dicks., is abundant and very fine in Madeira.

According to M. Schimper, *Ptychomitrium*, to which he refers *G. polyphyllum* and some other species, differs from *Glyphomitrium* in having the teeth of its peristome not approximated in pairs and

not hygroscopic; and *Brachysteleum* of Hornschuch (an older name applied to the same species) he is willing to retain for the reception of such species as have a short seta; but these are al the distinctions upon the strength of which they are to be considered coequal genera with *Glyphomitrium.*

Brachyodus, Nees et Hornschuch, and *Campylosteleum*, Bruch et Schimper, owe their distinction from *Glyphomitrium* chiefly to their diminutive size; besides which, the only characters in *Brachyodus* are the short peristome and the plication of the empty capsule, and in *Campylosteleum* the curved fruitstalk; for in the latter the peristome is similar to that of *Ptychomitrium.* All the species of these supposed genera agree in the areolation of their leaves, the mitriform calyptra, and in having a peristome which among them passes through similar forms to those observable in *Grimmia*, to which they appear to form an allied and closely related genus—differing in habit and areolation, but agreeing in the structure of the peristome, the highest development of which appears in *Glyphomitrium polyphyllum* and *Grimmia* (*Rhacomitrium*) *canescens*, Dill.

Ulota, *Brid.*

U. vittata, sp. nov. Habitu staturaque *U. Bruchii*, foliis patentibus siccitate crispatis e basi latiore subovata sensim lineari-lanceolatis apice obtusiusculis nervo carinatis integerrimis, cellulis basi ad latera seriebus singulis hyalinis quadratis interioribus ad nervum elongatis angustis, ad margines usque ad folii medium seriebus circiter sex cellularum elongatarum angustarum vittam plus minus distinctam formantibus, theca ovali sensim in pedunculum attenuata siccitate plicata rubrofusca, peristomio *U. Bruchii*, calyptra ramentis paucis brevibus appressis.

Hab. Madeira, on trees on the mountains, *Johnson.*

Different from *U. crispa*, Hedw., and *U. Bruchii*, Hsch., in its calyptra and in the presence of the bands of elongated cells, which are not truly marginal, for a single row of rounded cells forms the margin; this vittation is not uniformly evident in every leaf, but is generally so. The rounded cells of the upper part of the leaf are about half the size of those of *U. crispa.*

Bryum, *Dill.*

B. Notarisii, sp. nov. Dioicum, dense cæspitosum, nitidum, foliis confertis patentibus ovato-lanceolatis apice latiusculo apiculo parvo sensim acuminatisve nervo crassiusculo in mucronem excurrente, margine superne parce denticulato medio recurvo, cellulis basi quadratis oblongis deinde longioribus prosenchymaticis, perichætialibus basi

latioribus, theca in pedunculo gracili rubro horizontali pendulave clavata rubra, operculo conico, peristomio dentibus angustis elongatis pallidis, interno carente.—*B. alpinum*, var. *Mediterraneum*, De Notaris, Syll. p. 129. *B. princeps* et *nuperius*, *B. gemmiparum*, ejusd. MS. *B. semicompletum*, Mitten in lit.

Hab. Madeira, on the earth in moist places, *Johnson*. In insulis freti Bonifacii maris Mediterranei, *De Notaris*.

Intermediate in size between *B. alpinum*, Linn., and *B. Sauteri*, B. et S., but most nearly allied to the former, from which it is distinguished by its smaller size, short densely tufted stems, and the form and substance of the leaves. In all the specimens yet examined there has been no trace of internal peristome.

B. OBOVATUM, sp. nov. Dioicum, foliis patentibus obovatis rigidis nervo crasso breviter excurrente mucronatis, margine crasso tereti superne parce indistincte denticulato, cellulis fere omnibus conformibus utriculo repletis basi nec oblongis nec rectangularibus, theca in pedunculo elongato clavato-cylindracea pendula, operculo conico, peristomio normali.

Hab. Madeira, near Funchal, on the earth, 1858, *Johnson*.

Like *B. Donianum*, Grev., in size and habit, but with leaves twice as wide, having a firm terete margin, and cells much smaller; in the same particulars it differs from *B. capillare*, Hedw., which is also found in Madeira.

LEPIDOPILUM, *Brid.*

(*Tetrastichium.*)

L. FONTANUM, sp. nov. Caule prostrato viridi vage ramoso simplicive, foliis quadrifariis compressis planis, seriebus dorsalibus divergentibus majoribus elongato-oblongis apice acuminatis basi asymmetricis margine apice serrulatis inferne integerrimis enerviis, seriebus ventralibus patenti-divergentibus angustioribus ovali-lanceolatis subintegerrimis, cellulis laxissimis prosenchymaticis pellucidis.

Hab. Madeira, Joaõ Gomez Ravine, about springs, *Johnson*.

The specimens of this fine moss are too fragmentary to give a good idea of its habit; it appears to be prostrate, but not rooting. Some of the specimens are more than 2 inches long, and produce irregular branches resembling the main stem; others have numerous short branches with uniform small oval obtuse leaves, still retaining, however, the quadrifarious arrangement; but in both cases the branches are confined to one side of the stem. The leaves are pale glaucous green, and so inserted as to leave the stem continuously visible along the dorsal side; the arrangement in

four series is similar to that of *L. Patrisiæ*, Hampe, but the relative size of the series is reversed.

Hookeria Splitgerberi, Mont., is, from the description, evidently another member of this small group, which differs from *Lepidopilum* in wanting the dorsal, medial, and ventral series of leaves.

Hookeria læte-virens, Hook. et Tayl., is found in Madeira, and in its pale appearance and size has some resemblance to *L. fontanum*, but the areolation of its leaves, as well as their insertion, is different.

SEMATOPHYLLUM, gen. nov.

Pleurocarpicum. Habitus, fructus peristomiumque *Hypni*. *Folia* cellulis alaribus utplurimum utrinque tribus distinctis signata.

(*Rhaphidorrhynchum*, Schimp.)

S. AURICOMUM, sp. nov. Monoicum, caule prostrato fusco ramis brevibus pinnato, foliis patentibus anguste ellipticis longe subulato-attenuatis concavis enerviis integerrimis, cellulis elongatis angustis, alaribus utrinque tribus fuscis, perichætialibus patentibus e basi subovata sensim angustatis integerrimis breviter nervatis, theca in pedunculo gracili rubro elongato apice cygni colli flexo ovali-cylindracea subinæquali ætate curvata, peristomio dentibus crassis intus valde trabeculatis, processibus carinatis solidis, ciliis binis subæquilongis lævibus.

***Hab.* Madeira, on decayed wood, *Johnson*.**

A small species, closely investing the wood, of a yellow and rather glossy appearance, related to *S.* (*Hypnum*) *leptocarpum*, Schw., but much less; allied also to *S. demissum*, Wils.; not, however, very nearly resembling it or any other European moss.

The numerous tropical species belonging to this group are readily distinguished from the *Hypna* and *Stereodontes* by the presence of the enlarged alar cells, which are distinct in form and colour from the rest of the substance of the leaf. Their affinity is remote from *Rhynchostegium*, Schimp., of which his *Rhaphidostegium* was made a section, to include *Hypnum demissum*, Wils.

STEREODON, *Brid.*

S. CANARIENSIS, sp. nov. Dioicus, cæspitosus, caule procumbente pinnatim ramoso, foliis falcatis secundis compressis ovato-lanceolatis ovali-lanceolatisque sensim acutis, marginibus superne argute serrulatis, nervis binis brevibus, cellulis elongatis longitudine circiter $\frac{1}{7000}$–$\frac{1}{8000}$, latitudine $\frac{1}{5000}$ unciæ metientibus, ad angulos paucis obscurioribus, perichætialibus erectis elliptico-lanceolatis apicibus serrulatis, theca in pedunculo elongato gracili brevi ovali inæquali horizontali,

ore magno, operculo conico acuminato, peristomio interno processibus solidis ciliis binis æquilongis in membrana fere ad dentium medium exserta.

Hab. Canaries, *ex Herb. Webb.*; Teneriffe, *Bourgeau, in Herb. Hook.*; Madeira, *Johnson*; Ireland, on Turk Mountain, 1829, *Wilson.*

Nearly resembling *S. cupressiformis*, Brid., in the state called "*mammillatus*," but differing from all states of that variable moss in the sharp serrulation of its leaves and in the size of the cells—about half as long and nearly twice as wide. In some specimens the capsule is very short—not longer than wide.

HYPNUM, *Dill.*

(*Rhynchostegium*, Schimp.)

H. SURRECTUM, sp. nov. Monoicum, caule repente radicante ramis pluribus brevibus pinnatim ramoso, foliis patentibus sursum curvatis surrectis nitidis e basi ovata longe subulato-lanceolatis, nervo medio evanido, marginibus integerrimis in ramulorum apicibus serrulatis, cellulis basi paucis majoribus latioribus superioribus elongatis angustis, perichætialibus subsecundis ovatis subulato-acuminatis subserrulatis nervo brevi, theca in pedunculo brevi lævi ovali horizontali, operculo subulato longirostrato, peristomio interno processibus perforatis, ciliis duobus dimidio brevioribus, in membrana fere ad dentium medium exserta.

Hab. Madeira, on stones, *Johnson.*

A shining green moss, in size resembling *H. confertum*, Dicks., and in the form of its leaves intermediate between it and *H. tenellum*, Dicks. It is remarkable for having all its leaves curved upwards in the same way as those of *H. resupinatum*, Wils.

(*Amblystegium*, Schimp.)

H. MADERENSE, sp. nov. Monoicum, caule repente latissime cæspitoso pinnatim ramoso, foliis patenti-divergentibus e basi subovata sensim subulato-lanceolatis, nervo percurrente, marginibus integerrimis subserrulatisve cellulis oblongo-ellipticis, perichætialibus erectis convolutis ovato-lanceolatis obtusatis nervo excurrente mucronatis plicatis, theca in pedunculo gracili rubro longissimo arcuata cylindracea, operculo convexo apiculato, peristomio interno processibus latis solidis, ciliis binis æquilongis interpositis, in membrana fere ad dentium medium exserta.

Hab. Madeira, on rocks and the earth, *Johnson*, and *Milne in Herb. Hook.*; Canaries, *Montagne.*

This fine species has the habit and appearance of *H. serpens*, Linn., but is in all its parts far larger and more rigid. It grows in extensive patches of a fresh green or, sometimes, brownish

colour; the fruitstalks are about 2 inches long. In the areolation of its leaves it is intermediate between *H. serpens* and *H. varium*, Beauv.

NECKERA, *Hedw.*

(*Homalia*, Brid.)

N. SUBRECTA, sp. nov. Habitu *N. trichomanoidis* simillima, foliis patentibus obovatis basi angustatis apice rotundatis crenulatis apiculo brevi, nervo distincto ad $\frac{3}{4}$ evanido, cellulis minoribus, perichætialibus ovatis acuminatis apicibus denticulatis, theca in pedunculo elongato brevi ovali inclinata, operculo conico-acuminato, peristomio interno processibus perforatis ciliis brevibus rudimentariis interpositis in membrana fere ad dentium medium exserta.

Hab. Madeira, Santa Luzia Levada, about the roots of *Thamnium alopecurum, Johnson.*

Very closely resembling *N. trichomanoides*; but its leaves are scarcely at all curved, the nerve stouter and longer, and the lower portions of the leaves narrowed, so that their figure is uniformly obovate.

LESKEA, *Hedw.*

(*Sciaromium.*)

Caulis primarius repens, radicans; rami erecti, inferne simplices, superne pinnati pendulive prolixique, ramosi. *Folia* rigida, opaca, sublævia, uninervia. *Cellulæ* parvæ, rotundatæ. *Phyllidia* nulla. *Peristomium* normale.

L. SPINOSA, sp. nov. Caule primario repente radicante, ramis erectis rigidis superne ramosis frondem stipitatem formantibus, foliis obscure viridibus rigidis patentibus e basi ovata sensim longe subulatis, nervo crasso concolore in apice evanido, marginibus apice parce remote dentatis alibi integerrimis, cellulis minutis rotundatis longitudine $\frac{1}{2000}$, latitudine $\frac{1}{3000}$ unciæ circiter metientibus lævibus.

Hab. Madeira, *Johnson and Mason*; Azores, *Hunt*, from *Watson.*

In all respects very similar to *Hypnum hispidum*, Hook. f. et Wils. Crypt. Antarct. t. 61, but more robust, and with leaves having the nerve when closely examined not excurrent but vanishing in the upper portion of the points, which too are dentate. The cells are also rather smaller.

Judging from the specimens, it would appear that well-developed stems would be from 4 to 6 inches high, and less curved than is usual in *H. hispidum.*

L. PROLIXA, sp. nov. Habitu *L. spinosæ* sed graciliore mollioreque, foliis patenti-erectis ovatis acuminatis leniter biplicatis, nervo lato crasso sub apice evanido, marginibus superne indistincte serrulatis,

cellulis parvis ovalibus inter se remotiusculis lævibus, perichætialibus elongatis erectis late lanceolatis acuminatis superne serrulatis, nervo in apice evanido, theca in pedunculo gracili subunciali rubro apice curvato breviter ovali æquali, collo nullo, operculo conico acuminato, peristomio dentibus luteis subulatis, processibus subæquilongis carinatis perforatis, ciliis tribus appendiculatis interpositis in membrana ad ⅓ dentium longitudinis exserta.

Hab. Madeira, near Funchal, 1857, *Johnson.*

Habit similar to the preceding, but not so rigid nor of so dull a green colour. Ramification less stiff; and some branches are produced as if they had grown in a subpendulous manner. The leaves are not subulate; the nerve wider, and vanishing considerably below the apex.

L. SETIGERA, sp. nov. Habitu *L. spinosæ,* foliis patenti-secundis ovatis concavis, marginibus minute crenulatis, nervo crasso compresso viridi excurrente folii longitudinem triplo superante lævi, cellulis parvis ovoideis basi paucis longioribus.

Hab. Madeira, 1862, *Johnson.*

In aspect entirely similar to *L. spinosa,* but in the few stems yet seen less distinctly pinnate, although forming the same tree-like branches. The great length of the firm and stout green nerve is remarkable.

The species composing this group, and including the *Hypnum hispidum,* Hook. f. et Wils., are here placed as a section of *Leskea,* that being the oldest name under which certain species having the structure and habit of *L. polycarpa,* Ehrh., were distinguished from *Hypnum,* and, like most of the earlier genera, established upon peristomial characters only. But with an extensive series of species it becomes evident that the most perfect form known amongst the mosses having the same areolation and mode of growth is found in *L. tamariscina* (*Thuidium,* Schimper), notwithstanding the apparently different habit and ramification; for in this species the peristome has the same development as in the most complete forms of *Hypnum* and *Bryum*; and diverse as *L. polycarpa* looks in imperfect specimens, when examined in favourable situations it is found to produce occasionally free stems which in ramification and appearance closely resemble *L. abietina* (*Thuidium,* Schimp.); and from this last species the transition into the more branched forms is so easy when even the allied European species are compared, that M. Schimper has not ventured to separate it from his *Thuidium.* And as to the peristome of *Leskea,* taking for example again *L. polycarpa,* it will be observed that it does not differ in structure

from that of *L. tamariscina*, but only in the non-development of those parts of the internal peristome which are present in that species, and that the group of *Leskeæ* with erect capsules and imperfect peristomes is precisely analogous to *Pylaiesia* and *Homalothecium*, Schimp.,—*Pylaiesia* having just the same position with regard to *Stereodon cupressiformis*, Brid., and *Homalothecium* to *Hypnum rutabulum*, Dill. In *Hypnum hispidum* and in *L. prolixa* the peristome is fully developed, and the habit approaches to that of *Thuidium*; but the stems and branches are destitute of the phyllidia so general amongst Leskeoid mosses, and the cells of the leaves are but very slightly papillose. M. C. Müller places *Hypnum hispidum* by the side of *H. fluviatile*, Sw.; but the habit and capsule are different, and the substance of the leaves more rigid. Besides the *H. hispidum*, there is in New Zealand another species belonging to the same group, *Leskea umbrosa*, M.; but little can be said of its habit, for small specimens only have yet been seen. *Hypnum nervosum*, Hooker, and *H. crispulum*, Dzy. et Molk., appear to be possessed of the same habit, but are much less. In time other species may be discovered, which will either confirm the position of the group in *Leskea*, or perhaps show them to be some modification of *Hypnum* with a dense areolation.

HEPATICÆ.

Lejeunia, *Dumort.*

L. Johnsoniana, sp. nov. Caule repente vage ramoso, foliis divergentibus orbiculari-ovatis angulo parvo acutis, basi lobulo subsaccato inflexo oblongo apice bidentulo, amphigastriis orbiculari-obovatis integerrimis, perianthio compresso obovato obtuso, ore parvo apiculato, utrinque ala dentata marginata, foliis involucralibus elliptico-oblongis apice paucidentatis, amphigastrio majore obtuso.

Hab. Madeira, creeping on *Madotheca Canariensis*, Nees, *Johnson*, 1859.

Whole plant brown, about the size of *L. serpyllifolia*, Lib., but agreeing in the form of its perianth with *L.* (*Phragmicoma*) *Mackaii*, and thus removed from the vicinity of the species which are allied to *L. subfusca*, Nees, with which it agrees in the form and substance of its leaves as well as in size and colour.

EXPLANATION OF THE PLATES.

Plate I.

Leskea spinosa. Plant, natural size; leaf, magnified.

Leskea prolixa. *a*, Plants, natural size. *b*, Leaf; *c*, perichætial leaf; *d*, capsule; *e*, portion of peristome: all magnified.

Leskea setigera. Plant, natural size; leaf, magnified.

PLATE II.

Sematophyllum auricomum. *a*, Plant, natural size. *b*, Leaf; *c*, perichætium and male flower; *d*, capsule; *e*, portion of peristome: all magnified.

Hypnum surrectum. *a*, Plant, natural size. *b*, Leaves; *c*, perichætium and male flower; *d*, capsule; *e*, portion of peristome: all magnified.

Lejeunia Johnsoniana. *a*, Plant, natural size. *b*, Portion of stem with leaves and stipules; *c*, involucral leaf detached; *d*, perianth, with involucral leaves and stipule; *e*, transverse section of perianth.

A New Genus of *Asclepiadeæ*. By N. A. DALZELL, Esq., Superintendent of the Botanical Gardens, Bombay. Communicated by Dr. THOMSON, F.L.S.

[Read March 3, 1864.]

[PLATE III.]

FREREA.

Calyx 5-partitus. *Corolla* glabra, rotata, 5-lobata, lobis late triangularibus, margine pilis raris aplanatis fimbriatis, sinu parvo acuto inter lobos. *Corona staminea* gamophylla simplici serie 10-lobata, nempe lobis 5 laciniis corollinis oppositis, latis brevissimis, sinuato-truncatis, 5 iis alternis ligulatis, antheris incumbentibus, apice truncatis. *Antheræ* apice simplices; massæ pollinis erectæ, supra basin affixæ, margine interiore linea aurea pellucida instructæ. *Stigma* muticum. *Folliculi?*—*Herba* Indica perennis humilis cæspitosa ramosa saxicola, caulibus teretibus albidis lævibus, foliis breviter petiolatis oblongis carnosis, floribus extra-axillaribus solitariis, brevissime pedunculatis.

1. F. INDICA, *Dalzell.*

Hab. Concan, alt. 3000 ped.

I met with this plant while botanizing a few days ago on a hill-fort in this neighbourhood, 3000 feet high. It was growing in large flattish patches on the bare rock on the western face of the hill. The flowers were pretty numerous; they are of a purplish-red colour, with an irregular small pale-yellow spot in the middle of each lobe; the staminal crown is dark purple, five of its segments resting on the edge of the stigma, which is of a pearly lustre. Between these five segments lie the anthers, which are quite exposed, of a fine red colour, their bases diverging, and having a line of a transparent golden or amber colour along their inner margin,

the gland connecting them being of a bright ruby colour. The whole central part is like a little gem—a pearl set round with small rubies.

In the structure of its flower it comes nearest to *Boucerosia*, but differs in its perfectly rotate corolla, while in habit and appearance it is far removed from *Stapelia*, *Boucerosia*, and *Caralluma*. It approaches in habit to some Euphorbias, having a miniature resemblance to *E. nivulia*, barring the thorns. I dedicate this genus to Sir H. B. E. Frere, not only as a mark of esteem and respect, but also because he always has been the enlightened encourager and promoter of scientific researches in India, and is himself a close observer of nature.

EXPLANATION OF PLATE III.

Fig. 1. Flower from behind, showing calyx.
2. Flower viewed laterally.
3. Flower viewed from above.
4. Corona and stigma. All magnified.

Description of a New Genus of *Scrophularineæ* from Martaban.

By Dr. J. D. HOOKER and Dr. T. THOMSON.

[Read March 3, 1864.]

[PLATE IV.]

BRANDISIA.

Calyx campanulatus, 5-costatus, subæqualiter 5(–7)-dentatus. *Corolla* infundibuliformis, bilabiata; labio postico exteriore magno, concavo, obtuso, subtruncato, integro; antico trilobo, segmentis subæqualibus. *Stamina* 4, tubo corollæ prope basin affixa, didynama, adscendentia, subexserta, quinti rudimento 0. *Filamenta* glabra; *antheræ* rotundatæ, biloculares, loculis superne confluentibus, antice et margine longe pilosæ, dorso glabræ. *Ovarium* biloculare, placentis in loculos porrectis multiovulatis. *Stylus* elongatus, filiformis, glaber, superne subclavatus, integer, apice minute stigmatosus. *Ovula* ∞, lineari-oblonga, tenuia.—*Frutex* scandens vel sarmentosus, oppositifolius. *Flores* axillares, solitarii, pedicellis bibracteolatis.

B. DISCOLOR, *H. f. et T.* Ramuli elongati, graciles, rotundati, fusco-tomentosi. Folia oblongo-lanceolata, 2–3 poll. longa, 1–1½ lata, petiolo ⅓-poll., subcoriacea, juniora utrinque dense flocceso-tomentosa,

pilis stellatis; adulta superne, costa excepta, glabra, atro-viridia, siccitate atrata, subtus cum petiolo tomentosa. Pedicelli vix pollicares, cum calyce dense tomentosi, supra medium bracteolis 2 linearibus muniti. Calycis dentes basi lati, subtriangulares, tubo $\frac{1}{2}$ breviores, normaliter 5, sæpe 6 vel 7. Corolla pollicaris, extus fusco-tomentosa, ima basi glabra, tubo intus glabro, limbo utrinque pubescente. Ovarium dense tomentosum. Stylus glaber.

We dedicate this very interesting genus to its discoverer, Dr. Brandis, the head of the forest-department in Pegu, an excellent botanist, who has made extensive and most valuable collections in the forests under his charge.

The general appearance of the plant is so little like Scrophularineæ, that it was only after examining the ovary that we were induced to place it there. The aspect of *Brandisia* is so very Verbenaceous, that we placed it in that family till we ascertained that it was many-ovuled. The order can, in fact, only be approximately determined, as the dehiscence of the fruit and the structure of the seed are unknown. If the seeds be exalbuminous, it will go to Bignoniaceæ; but the ovary and placentation are so much like Scrophularineæ, that in all probability albumen will be found in the seeds.

The position of *Brandisia* among Scrophularineæ, as Mr. Bentham has kindly pointed out, is probably among *Cheloneæ*, the only tribe in which large woody climbing plants occur. The flowers, though solitary, have two opposite bracteoles on the pedicel, and the curiously elongate ovules probably become winged seeds like those of *Wightia*.

EXPLANATION OF PLATE IV.

Fig. 1. Peduncle and flower.
2. Corolla laid open.
3. Back and front of anther.
4. Pistil.
5. Transverse section of ovary.
6. Peduncle and young fruit.

The "Bryologia" of the Survey of the 49th Parallel of Latitude.

By William Mitten, A.L.S.

[Read Jan. 22, 1864.]

[Plates V.—VIII.]

The Mosses collected during the expeditions for the survey of the 49th Parallel owe their principal interest to the specimen

gathered by Dr. Lyall on the west side of the Rocky Mountains and in Vancouver Island, and these contain certain species which appear to be peculiar to that region, all the species from the country on the east side of the Rocky Mountains having been previously gathered by Drummond. Considering the vast extent of British America with regard to the specimens in herbaria, it becomes at once evident that but very little is yet known of its Moss-flora beyond the fact that it is very nearly identical with that of the north of Europe, and, so far as known, with but few peculiar species. A great gap exists in British herbaria in the almost entire absence of collections from all that extensive tract of country between Davis's Straits, Hudson's Bay, and Nova Scotia; and as this includes a great extent of regions subject to marine influences, it must be expected to produce a very extensive series of species.

In the United States, chiefly owing to the zealous labours of Sullivant, the knowledge of the productions of the parts investigated by him and his coadjutors has been greatly increased; but the country is so extensive, and there remains such an unexplored region in the south, where the northern forms become exchanged for those of tropical regions, which may probably be better observed there than anywhere else, that it is to be expected that great additions have yet to be made before the Bryology of the United States is approximately exhausted. Besides the species actually collected during the survey, there have been added a few others, either overlooked or not before determined, mostly collected by Drummond.

The arrangement of the species contained in the following enumeration is different from that employed in the 'Musci Indici,' in which the pleurocarpous genera were arranged approximately in the order in which the substance of the leaves became more and more indurated and obscure; and the whole of the Hypnoid mosses were divided into two sections by the nerves of the leaves, those with a single nerve being considered species of *Hypnum*, and those with two nerves or more were referred to Bridel's *Stereodon*. But although this plan serves very well to break up the tribe into two sections, there occur here and there species which may sometimes answer to one and sometimes to the requirements of the other section; examples of this occur in the species grouped in *Limnobium*, Schimper, in *Isothecium*, and in *Hylocomium*, and are probably overlooked in many species; for in some the leaves of the main stem are faintly

two-nerved, and strongly one-nerved in the ultimate ramuli. Notwithstanding, however, the difficulty of defining the distinctions between the groups of Hypnoid mosses, Bridel's original group *Stereodon*, although incompletely viewed by him, may be said to differ from the *Hypna* of his arrangement in the more cylindric, less indurated capsule and short operculum, and in the habit of the species being somewhat different, the apices of the stems not usually descending and rooting in a proliferous manner as is the case with the *Hypna*. The mode of growth of the greater number of mosses is very little understood; for the comparison of a number of plants of the more abundant species, such as *Hypnum rutabulum*, Linn., will show that the habit assigned to *Rhynchostegium*, *Eurynchium*, and *Scleropodium* of Schimper is found in that species as well, and that the stem may be rooting its whole length, or erect and arcuate, or even subdendroid; and as all are equally fertile, one cannot be said to be less perfect than another. In the group *Stereodon* a number of aquatic species become erect in their mode of growth, from, as it would appear, their inability to increase in any other direction from the crowding of the stems together. In the 'Musci Indici' there was confused with the section *Stereodon* all that extensive group of species, chiefly tropical, which have distinct alar cells, generally three more distinctly conspicuous in each angle of the leaf, and a rostrate operculum; and these form another section or genus, *Sematophyllum*, which passes through a number of forms analogous to those of *Hypnum* and *Stereodon*.

In all arrangements of the Order Musci, up to the latest in M. Schimper's Synopsis (1860), the peristome is taken as the chief distinguishing character, and genera have been founded, and are maintained, upon characters dependent upon differences of which the value has been greatly overestimated; and even the straightness or curvature of the capsule is considered sufficient to constitute a distinct genus, and thus species are removed from proximity to those to which in every other particular they are so intimately allied as to be, in several cases, almost undistinguishable. Prominent examples of this occur in the *Trichostoma* as here understood, in which there is a regularly ascending series from *Pottia* through *Anacalypta* into *Desmatodon*; and as all these stages of development do occasionally occur in specimens of the same species, the conclusion seems unavoidable that the definition of a single genus should be sufficiently wide to contain them all. Very nearly the same position is occupied by the

species of the genus *Trichostomum* allied to *T. flavovirens* in respect of *Tortula*: taking for the typical species *T. tortuosa*, the only difference is in the shorter teeth of the peristome, the structure being identical. The same analogies exist in the development of the peristome of the pleurocarpous mosses, as, for example, in the capsule and peristome of the so-called genera *Homalothecium* and *Camptothecium*. In the species contained in these genera, the resemblance between the plants without the fruit is so great that it requires an expert bryologist to distinguish them from each other. The same is the case with *Pylaiesia*, which without fruit or inflorescence could hardly be known from *Hypnum cupressiforme*. It would seem, therefore, that a natural group of Mosses can only be defined from the structure of the species in which the highest development is found. All those species which agree in all other respects, as habit, ramification, position of the fruit, form, and substance of the leaves, but present a less development of peristome, should be considered as only affording a negative difference, of barely specific value. There would appear to be no escape from this conclusion among the acrocarpous genera; and as there is no difference in the structure of the peristome in the pleurocarpous, it must be applicable to the whole group of Arthrodontoid mosses.

MUSCI.

DICRANACEÆ, *Mitten, Musci Ind.*

Cynodontium, *Hedw.*

(*Distichium*, B. et S.)

C. capillaceum, *Hedw.*
Hab. Near Fort Ellice, Saskatchewan, and Rocky Mountains, *Bourgeau*; Cascade Mountains, *Lyall.*

C. inclinatum, *Hedw.*
Hab. Saskatchewan, *Bourgeau.*

(*Leptotrichum*, Hampe.)

C. flexicaule, *Schw.*
Hab. Cascade Mountains, *Lyall.*

(*Dicranella*, Schimp.)

C. crispum, (Dicranum) *Hedw.*
Hab. Galton Mountains, *Lyall.*

C. subulatum, (Dicranum) *Hedw.*
Hab. Galton Mountains, *Lyall.*

C. HETEROMALLUM, (Dicranum) *Hedw.*
Hab. Cascade Mountains, *Lyall.*

The genus *Cynodontium* of Hedwig, as described in the 'Species Muscorum,' contains, besides *C. capillaceum* and *C. inclinatum*, two other species which have long since been removed to other genera; and although *Distichium*, applied by Schimper to the two species with distichous leaves, is more expressive so far as relates to them in particular, yet it seems hardly possible to maintain a genus solely on this character, much less a natural family *Distichiæ*, when there is no appreciable difference in form or structure from the species allied to *Cynodontium flexicaule*, Schw., and the numerous species which agree with it in structure and habit. These, separated by Hampe from the other mosses usually referred to the genus *Trichostomum*, have been of late placed in the genus *Leptotrichum*, Hampe; recently, however, it has been pointed out by Lindberg that this name was already in use for a genus of Fungi, and he proposed instead of *Leptotrichum* the name *Diaphanophyllum*, Lindbg.; but on looking back in the history of the species it would appear that there is no reason why Hedwig's genus, considered as it must have been by Schwägrichen when he added *C. flexicaule* to it, should not be reinstated. The generic name *Trichostomum*, under which a number of species referable to *Cynodontium* have been arranged, cannot be employed, for reasons which will be stated elsewhere. If it be granted that the *Dicranaceæ* are a group of species of which the genus *Dicranum* is the typical form, and which may contain a series of progressive developments from *Archidium* through *Pleuridium*, *Bruchia*, *Garckea*, into *Cynodontium*, the place of the last-named genus must be very close to *Dicranum*, and its only difference the absence of distinct alar cells. No generically distinctive character can be drawn from the peristome, which in point of structure is alike in all the species of the family, and attains its highest known development in *Dicranum*. The structure of the leaves is nearly the same in all, excepting in the genera *Didymodon* and *Holomitrium*, in which the cells become shortened in the upper portions and thus approach to the *Trichostoma*. The aggregation of the cleistocarpous genera *Archidium* and *Pleuridium* in the same group of genera with *Dicranum* is a breaking up of the old idea of a separate family for the Phascoid mosses; but it may be observed that the sole difference between *Pleuridium* and *Cynodontium* is the absence of a deciduous operculum; and that all the other Phascoid genera are referable to other more highly developed families is

evident from the close affinity among those belonging to the *Trichostoma*.

Overlooked amongst Drummond's specimens is

C. Canadense. **Dioicum?, caule brevi simplici, foliis e basi erecta subquadrata superne latiore vaginante subulato-lanceolatis divaricatis, nervo percurrente valido, marginibus serrulatis, cellulis basi elongatis inde suboblongis marginalibus brevioribus omnibus pellucidis, perichætialibus parum majoribus conformibus, theca in pedunculo elongato rubro turbinata inæquali, ore magno, dentibus validis rubris dicranis.**

Hab. **British N. America (probably from the Rocky Mountains), *Drummond*, no. 101 part.**

In colour and appearance like a small state of *C. squarrosum*, (*Dicranum*) Schrad. Stems two or three lines high; seta about half an inch long or more. The leaves are pellucid, and differ from those of *C. squarrosum* in the more subulate narrower points and serrulate margins. This forms the third known species, corresponding closely with *C. squarrosum*—the Indian *C. patulum*, (*Leptotrichum*) Mitten, having leaves of the same outline, but serrulate, and, so far as can be seen, it is of a smaller size.

No species of *Archidium* has yet been noticed from British North America. Several occur in the United States, and the following appears to have escaped notice.

Archidium, *Brid.*

A. tenerrimum. **Foliis lanceolatis subserratis nervo excurrente, cellulis elongatis laxis, perichætialibus e basi ovali subulato-lanceolatis, florescentia fructuque *A. phascoidis*.**

Hab. **Louisiana, *Drummond*, 2. no. 11 (as *A. phascoides*).**

In the decidedly excurrent nerve and very lax areolation of the leaves this species is certainly distinct from *A. phascoides*, Brid. *A. Ohioense*, Sullivant, to which it is also closely allied in habit and general appearance as well as in the excurrent nerve, has its antheridia in distinct flowers, and the cells of its leaves not quite half so long and more close and firm.

Dicranum, *Hedw.*

D. strictum, *Schleich.*

Hab. **Fort Colville, *Lyall*. Gathered also in British America by *Drummond*; Lake Huron, *Todd*; and in the United States by *Cooley*, and near Boston, *Green*. It is not enumerated by Sullivant.**

D. flagellare, *Hedw.*

Hab. **Fort Pitt, Saskatchewan, *Bourgeau*.**

D. FUSCESCENS, *Turner.*
Hab. Cascade Mountains and Galton Mountains, *Lyall*; Winnipeg, *Bourgeau.*

D. PALLIDUM, *B. et S.*
Hab. British Columbia, *Lyall.* Gathered also in N.W. America by *Douglas* and *Seemann.* It appears to be generally distributed in N. America.

D. SCOPARIUM (*Linn.*).
Hab. British Columbia, *Lyall*; N.W. America, *Seemann*; Columbia, *Douglas.* It occurs as far north as Baffin's Bay, but according to Sullivant is less common than the preceding in the United States.

D. PALUSTRE, *La Pyl.*
Hab. Pend Oreille River and Semihamoo Bay, *Lyall*; Vancouver Island, *Wood*; Lake Winnipeg, *Bourgeau.* Generally distributed.

D. UNDULATUM, *Turner.* D. polysetum, *Sw.*
Hab. Saskatchewan, *Bourgeau.*

D. DRUMMONDII, *C. Müller.*
Hab. Saskatchewan and Portage de la Prairie, Lake Winnipeg, *Bourgeau.*

D. SCHRADERI, *Schw.*
Hab. Saskatchewan, *Bourgeau.*

D. LONGIFOLIUM, *Hedw.*
Hab. Portage de la Prêle, Lake Winnipeg, *Bourgeau.*

D. enerve, Thed. (*D. albicans*, B. et S.), was gathered by Douglas in N.W. America.

HOLOMITRIUM, *Brid.*

H. CIRRHATUM, (Weissia) *Hedw.*
Hab. Vancouver Island and British Columbia, *Lyall.* Collected *Douglas* in N.W. America.

H. CRISPULUM, (Weissia) *Hedw.*
Hab. Galton Mountains and near Fort Colville, *Lyall.*

DIDYMODON, *Hedw.*

(*Amphoridium*, Schimp.)

D. LAPPONICUS, (Gymnostomum) *Hedw.*
Hab. Cascade Mountains, *Lyall.*

D. CÆSPITOSUS, sp. nov. *D. Mougeotii* habitu staturaque simillimus, foliis e basi erecta patentibus apice incurvo erectis sensim acutis remote serrulatis, cellulis basi oblongis rectangulatis, deinde in ovoideas et superne in rotundatas transeuntibus.
Hab. Vancouver Island, *Lyall.*

In pale-green tufts, to all external appearance like *D. Mougeotii*, (*Amphoridium*) Schimp., but leaves gradually narrowed into an acute point, and the margin remotely serrulate as in *D. cyathicarpus*, (*Zygodon*) Mont.; the cells of the base of the leaf are not linear and narrow as in that species.

All the above-named species are regarded by me as imperfectly peristomate forms of *Rhabdoweissia*, Schimp., which is itself composed of species passing into the complete forms observable in *D. polycarpus*, *D. virens*, and *D. Wahlenbergii*.

(*Ceratodon*, Brid.)

D. PURPUREUS (*Linn.*).
Hab. Lake Winnipeg, *Bourgeau*; Cascade Mountains, British Columbia, and Vancouver Island, *Lyall.*

(*Oncophorus*, Brid.)

D. POLYCARPUS, (Dicranum) *Ehrh.*
Hab. Cascade Mountains, *Lyall*; Saskatchewan, *Bourgeau.*

D. VIRENS, (Dicranum) *Hedw.*
Hab. Galton Mountains, alt. 6000–7000 feet; British Columbia, *Lyall.*

D. WAHLENBERGII, *Brid.*
Hab. Saskatchewan, *Bourgeau.*

No species of *Didymodon* of the section *Leptodontium*, Hampe, has yet been received from British N. America; but the *Syrrhopodon excelsus*, Sullivant, referred by Müller to *Zygodon*, appears to be a slender state of a species which has been sent in a fertile state from Mexico, and corresponds nearly with the description of *Trichostomum ulocalyx*, C. Müller.

GRIMMIACEÆ.

GRIMMIA, *Ehrh.*

(*Scouleria*, Hook.)

G. SCOULERI, *C. Müller.*
Hab. On stones in the Columbia River, Fort Colville, *Lyall.*

(*Schistidium*, Brid.)

G. APOCARPA (*Linn.*).
Hab. Rocky Mountains, *Bourgeau*; Cascade Mountains and Fort Colville, *Lyall*; N.W. America, *Douglas.*

Generally distributed in British N. America; and from the numerous specimens brought by Mr. Taylor from Davis's Straits, it would appear to be abundant in that region. Amongst his

specimens there occurred a few of what appears to be a different species:—

G. PLATYPHYLLA. Foliis incurvis imbricatis late ovatis apice obtusis apiculove brevi diaphano terminatis marginibus revolutis nervo in apice evanido, foliis perichætialibus late ovali-oblongis apice obtuse angulatis, cellulis elongatis teneris fere ad apicem usque areolatis, theca immersa; cætera *G. apocarpæ* similis.

Hab. Davis's Straits, *Taylor.*

In habit, colour, and general appearance agreeing with *G. apocarpa*, var. *stricta*; but its leaves are more than twice as wide, and both in the wet and dry state imbricated; in their substance and areolation they agree exactly with those of *G. apocarpa*, and the capsule and peristome appear precisely the same; the perichætial leaves are very laxly areolate for two-thirds of their length. The specimens, from their very wide leaves, are immediately distinguishable from all known varieties of *G. apocarpa.*

(*Eugrimmia*, C. Müller.)

G. LEUCOPHÆA, *Grev.*

Hab. Fort Colville, *Lyall.*

Rather more slender than European specimens.

G. ALPESTRIS, *Schleich.*

Hab. Fort Colville and Pend Oreille River, *Lyall.*

All the specimens very dark green, but not otherwise differing from European ones.

G. PULVINATA (*Linn.*).

Hab. Fort Colville, *Lyall.*

G. TRICHOPHYLLA, *Grev.*

Hab. Vancouver Island, *Lyall.*

G. PATENS, (Bryum) *Dicks.*

Hab. Between Fort Colville and the Rocky Mountains, *Lyall.*

(*Dryptodon*, Brid.)

G. ACICULARIS, *Linn.*

Hab. British Columbia, *Lyall and Douglas.*

The capsule in some specimens elongated; but in other particulars like the European moss.

(*Rhacomitrium*, Brid.)

G. HETEROSTICHA, (Trichostomum) *Hedw.*

Hab. Fort Colville and Pend Oreille River, *Lyall.*

G. VARIA, sp. nov. *G. fasciculari* simillima, sed major, foliis ovato-lanceolatis apice obtusis vel (superioribus) pilo brevi subintegerrimo, nervo percurrente, marginibus recurvis, cellulis basi ad latera paucis oblongis rectangulatis interioribus elongatis confluentibus crenulatis supra folii medium oblongis parietibus transversis distinctioribus supremis quadrato-rotundatis, perichætialibus brevibus late ovatis convolutis, theca in pedunculo elongato cylindracea nitida, operculo subulato subæquilongo, peristomio dentibus rubris prælongis angustis.

Hab. British Columbia, *Lyall and Douglas*; and also in Observatory Inlet.

Much more robust than *G. fascicularis*, and with short diaphanous points on some of its upper leaves. The leaves are below of an oblong-ovate form, the upper third constituting the lanceolate point; in this particular they are intermediate in outline between those of *G. fascicularis* and *G. canescens*, wanting, however, the laxly areolate auricles at the base in the latter. This moss needs further observation; but it can scarcely be considered a form of *G. fascicularis*.

G. CANESCENS (*Dill.*).
Hab. Vancouver Island, *Lyall*.

G. LANUGINOSA, *Dill.*
Hab. Vancouver Island, *Wood*.

No species of *Glyphomitrium*, Bridel, has yet been received from British Columbia; but amongst Drummond's incomplete specimens there occurs a small species which has never been described.

GLYPHOMITRIUM, *Brid.*

G. CANADENSE, sp. nov. Monoicum, humile, foliis lanceolatis sensim acutis, margine inferne recurvo, cellulis basi oblongis ad angulos angustatis inde in rotundas transeuntibus, perichætialibus latissime ovatis convolutis breviter apiculatis, theca in pedunculo bilineari ovali, calyptra apice rugosa, habitu *G. Daviesii* simillimum.

Hab. British N. America, *Drummond*.

The oval capsule and different areolation of the leaves readily distinguish this from *G. Daviesii*, which in size and appearance it much resembles. The operculum and peristome are absent.

BARTRAMIACEÆ, *Mitten*.

PHILONOTIS, *Brid.*

P. FONTANA, *Linn.*
Hab. Rocky Mountains, *Bourgeau*; Chilukweyuk and Fort Colville, *Lyall*.

BARTRAMIA, *Hedw.*

B. MENZIESII, *Turner.*
Hab. Vancouver Island, *Lyall.*

B. POMIFORMIS (*Linn.*).
Hab. Pend Oreille River and Sumass Prairie, *Lyall.*

B. ITHYPHYLLA, *Brid.*
Hab. Cascade Mountains and Rocky Mountains, *Lyall.*

B. ŒDERI (*Gunn.*). B. gracilis, *Schw.*
Hab. British Columbia near the 49th parallel, *Lyall.*

MEESIA, *Hedw.*

M. ULIGINOSA, *Hedw.*
Hab. Mooyie River (a branch of the Kootenay), *Lyall.*

M. TRISTICHA, *Funk.*
Hab. Pack River, *Lyall.*

FUNARIACEÆ, *Mitten.*

FUNARIA, *Schreb.*

F. HYGROMETRICA (*Linn.*).
Hab. Saskatchewan, *Bourgeau*; Fort Colville, Sinyakwateen, and Vancouver Island, *Lyall.*

SPLACHNACEÆ, *Mitten.*

TAYLORIA, *Hook.*

T. SERRATA, (Splachnum) *Hedw.*
Hab. Fort Colville, *Lyall.*

Splachnum melanocaulon, Schw., has been several times brought from Western N. America; and some specimens collected on the Rocky Mountains by Mr. Burke show an extraordinary variation in the capsules, which in some specimens are as figured by Schwägrichen, and in others varying in the length of the seta until the capsule is only just exserted beyond the leaves, and with or without an umbraculum.

BRYACEÆ, *Mitten.*

WEBERA, *Hedw.*

W. NUTANS, (Bryum) *Schreb.*
Hab. Saskatchewan, *Bourgeau*; Cascade Mountains and Galton Mountains, *Lyall.*

W. CRUDA, (Bryum) *Schreb.*
Hab. Fort Colville and Cascade Mountains, *Lyall.*

W. LONGICOLLA, (Bryum) *Sw.*
Hab. Cascade Mountains, *Lyall.*

W. ALBICANS, *Wahl.*
Hab. Galton Mountains, *Lyall.*

W. LUDWIGII, (Bryum) *Spreng.*
Hab. Cascade Mountains, *Lyall.*

W. PYRIFORMIS (*Linn.*).
Hab. Saskatchewan and Rocky Mountains, *Bourgeau*; Cascade Mountains, *Lyall.*

BRYUM, *Dill.*

B. ARCTICUM, (Pohlia) *Brown.*
Hab. Rocky Mountains, *Bourgeau.*

B. PURPURASCENS, (Pohlia) *Brown.*
Hab. Rocky Mountains, *Bourgeau.*

B. ULIGINOSUM, *B. et S.*
Hab. Rocky Mountains, *Bourgeau.*

B. BROWNII, *B. et S.*
Hab. Rocky Mountains, *Bourgeau.*

B. CÆSPITICIUM, *Linn.*
Hab. Saskatchewan, *Bourgeau*; Pack River, Cascade Mountains, Kettle Falls, and Galton Mountains, *Lyall.*

B. PALLESCENS, *Schleich.*
Hab. Cascade Mountains, *Lyall.*

B. BIMUM, *Schreb.*
Hab. Saskatchewan and Rocky Mountains, *Bourgeau*; Fort Colville and Galton Mountains, *Lyall.*

B. PSEUDOTRIQUETRUM, *Hedw.*
Hab. Rocky Mountains, *Bourgeau*; Fort Colville and Galton Mountains, *Lyall.*

B. DUVALII, *Voit.*
Hab. Fort Colville, *Lyall.*

B. TURBINATUM, *Hedw.*
Hab. Galton Mountains, *Lyall.*

B. CAPILLARE, *Linn.*
Hab. Vancouver Island, Pack River, and Galton Mountains, *Lyall.*

B. ARGENTEUM, *Linn.*
Hab. Rocky Mountains, *Bourgeau.*

ORTHOTRICHACEÆ, *Mitten.*

ORTHOTRICHUM, *Hedw.*

O. PALLENS, *Bruch.*
Hab. Pack River, British Columbia, *Lyall.*

O. STRANGULATUM, *Beauv.*
Hab. Cascade Mountains, British Columbia, *Lyall.*

O. ANOMALUM, *Hedw.*
Hab. Saskatchewan, *Bourgeau.*

O. SPECIOSUM, *Nees.*
Hab. On rocks near Fort Colville, *Lyall.*

O. ELEGANS, *Schw.*
Hab. Pend Oreille River, and between that and Kootenay River, British Columbia, *Lyall.*

The smooth capsule and rather more slender habit seem to be the only differences between this and the preceding; both forms are found in Europe.

Very large specimens of what appears to be the same as the European *O. Lyellii*, Hook., were gathered by Menzies on the N.W. coast of America, and were marked by Sir W. Hooker "*O. Menziesii*," but were never published; there is a great difference in the external look of the specimens, but no appreciable distinction.

O. CONSIMILE. Monoicum, pulvinatum, humile, foliis patentibus e basi ad insertionem angusta inde dilatatis ovato-lanceolatis nervo carinatis, marginibus recurvis reflexisve, cellulis basi paucis oblongis quadratisque superioribus rotundatis, perichætialibus conformibus, theca in pedunculo brevi exserta ovali siccitate plicata, operculo conico acuminato brevirostro, peristomio dentibus 8, ciliis simplicibus æquilongis 8 interpositis, calyptra plicata ramentosa.
Hab. Vancouver Island, on trees, *Lyall.*

Closely resembling *O. Columbicum*, but with shorter leaves. It is also allied to *O. pulchellum*, Sm., a species of which the position has not been well understood, it being sometimes placed in *Ulota*; but it agrees with the smaller species which correspond nearly with *O. speciosum*, Nees, and is truly an *Orthotrichum.*

O. COLUMBICUM. Monoicum, pulvinatum, humile, foliis e basi brevi oblonga erectiore longe lanceolatis patentibus apice latiuscule acutis nervo percurrente carinatis, marginibus reflexis, cellulis basi paucis elongatis superioribus subrotundis, perichætialibus brevibus, theca in pedunculo brevi exserta ovali-cylindracea siccitate plicata, peristomio dentibus 8, ciliis æquilongis 8 simplicibus alternantibus, calyptra plicata apice rugosa nuda.
Hab. Vancouver Island, on trees, *Lyall.*

In general appearance similar to *O. Tasmanicum*, Hook. f. et Wils., but rather less.

Amongst the American *Orthotricha* there occur several species which appear to have been overlooked, or to have been passed over as states of European species, but which on comparison do not appear to be identical with any previously known; of these are—

O. PARVULUM. Monoicum, humillimum, foliis patentibus elliptico-lanceolatis sensim acutis acutatis acuminatisque nervo carinatis, marginibus vix recurvis, cellulis basi ad angulos alares paucis oblongis fuscis, cæteris omnibus rotundatis, perichætialibus basi latioribus, theca immersa obovata plicata, peristomio dentibus 16, calyptra plicata ramentosa.—*O. Sturmii,* Sullivant.

Hab. Prope Santa Fe Neo-Mexicanorum, *Wright,* et in Novæ Angliæ alpibus, *Oakes.*

Very different from *O. Sturmii,* Hsch. et Hoppe, and in its foliage more like *O. tenellum,* Bruch.

O. PUSILLUM. Monoicum, brevissimum, foliis patentibus ovato-lanceolatis, inferioribus acutis, superioribus late acutatis obtusiusculis nervo carinatis, marginibus reflexis, cellulis basi quadratis pellucidis, superioribus rotundatis granulosis, perichætialibus interioribus brevioribus, theca immersa obovata siccitate 8-plicata leptoderma, peristomio dentibus 16 brevibus.

Hab. Pennsylvania, *Drummond.*

Less than *O. tenellum,* and with a very thin, short, pale capsule, and foliage more rigid than in *O. parvulum.*

O. COULTERI, sp. nov. Monoicum, habitu staturaque *O. tenelli,* foliis densis e basi erectiore subovali angustatis lanceolatis patentibus, apicibus latiusculis obtusiusculis subacutis, marginibus recurvis, nervo sub apice evanido carinatis, cellulis basi in folii medio paucis oblongis elongatisque latioribus, inde ad apicem abbreviatis quadratis rotundisque distinctis papillosis, perichætialibus erectioribus latioribus elliptico-lanceolatis acutioribus, vaginula ramentis elongatis pilosa, theca emersa ovali-cylindracea octies plicata in pedunculo sensim angustato, peristomio dentibus ciliisque tertia parte brevioribus angustis 8, calyptra ramentis brevibus appressis obtecta.

Hab. California, *Coulter.*

Very similar in appearance to *O. tenellum,* Bruch, but its capsules exserted beyond the apices of the perichætial leaves, which are more acute, its calyptra more pilose, its cilia short, and its male flowers larger.

The description of *O. cylindrocarpum,* Lesq., in which the peristome is stated to be "dentibus externis pallidis, ciliolis robustis longioribus albidis articulatis," and the calyptra "valde pilosa," indicates another nearly allied Californian species.

O. CANUM. Humile, foliis patentibus elliptico-lanceolatis nervo carinatis, marginibus recurvis reflexisve, apicem versus plus minus erosulis apice diaphanis, superioribus pilo brevi hyalino fragili terminatis, cellulis basi paucis oblongis quadratisque, inde ad apicem rotundatis granulosis grossiusculis, perichætialibus ovatis subacutis, theca emergente ovali-cylindracea plicata, operculo breviter acuminato, peristomio dentibus bigeminatis ciliis subulatis basi e serie duplici cellularum compositis interpositis, calyptra totam fere thecæ obtegente breviter ramentosa.

Hab. British N. America, *Drummond.*

Different from *O. diaphanum*, Schrad., in the form of its leaves, and in appearance more nearly like *O. pumilum*, Schw., which has differently shaped r leave s, also tipped with a minute hyaline fragile mucro.

ULOTA, *Brid.*

U. PHYLLANTHA, *Brid.*

Hab. Vancouver Island, *Wood.*

U. AMERICANA. Monoica, foliis siccitate tortis appressis e basi subovali longe lanceolatis sensim acutis nervo carinatis, marginibus recurvis, sæpe suberosis, cellulis basi ad margines seriebus circiter tribus hyalinis oblongis, in medio angustis luteis, superioribus rotundatis diametro circiter $\frac{1}{4000}$ unciæ metientibus, perichætialibus apice latioribus obtusiusculis, theca elliptica plicata, operculo conico acuminato, peristomio dentibus bigeminatis 8, ciliis æquilongis angustis 8, calyptra breviter appresse ramentosa.

Hab. Lake Huron, *Todd*; British N. America, *Drummond*, no.153, with *U. Bruchii* as *U. crispa*.

Differs from *U. curvifolia*, Wahlenb., in the areolation of the base of the leaf, and from *U. crispa*, Hedw., and *U. crispula*, Hsch., in the same particular, as well as in the form of the base of the leaves. The space of a thousandth part of an inch in the middle of the lanceolate part of the leaves contains in *U. crispa* two cells, in *U. crispulum* two and a half, in *U. Americana* three cells.

U. BARCLAYI. Monoica, cæspitosa, humilis, foliis patentibus siccitate appressis e basi excavata subrotundata late lanceolatis acutis, superioribus acutatis, nervo carinatis, marginibus convexis integerrimis, cellulis basi ad lateras oblongis in seriebus pluribus hyalinis, interioribus paucis elongatis luteis, superioribus rotundatis diametro circiter $\frac{1}{3000}$ unciæ metientibus, perichætialibus ovato-lanceolatis convolutis erectis, theca ovali et collo crasso siccitate plicata, peristomio dentibus bigeminatis 8, ciliis 8 brevioribus interpositis, calyptra breviuscula breviter ramentosa.

Hab. Sitka, *Barclay.*

A very small pale yellowish species, in the older portions rusty. Unlike any other known North American *Ulota*, having the leaves scarcely twisted when dry, and the very thick peduncle, which is the elongated neck of the capsule, when dry plicate, as well as the capsule itself, which is pale brown.

TRICHOSTOMACEÆ, *Mitten*.

* *Tortulæ*.

HYMENOSTYLIUM, *Brid*.

H. CURVIROSTRE, (Gymnostomum) *Hedw*.
Hab. Rocky Mountains, *Bourgeau*.

BARBULA, *Hedw*.

B. RUBIGINOSA. Dioica, *B. vineali* habitu staturaque affinis, foliis siccitate appressis curvatis, humidis patentibus, inferioribus ovatis, superioribus e basi ovata ad insertionem angustata angulis decurrentibus subulato-lanceolatis acutis, margine recurvo, nervo in apicem crassiusculum percurrente, cellulis minutis rotundatis subobscuris minute papillosis, perichætialibus erectis majoribus e basi elongato-ovali turgide laxe convoluta nervo excurrente subulato-apiculatis, theca in pedunculo rubro ovali-cylindracea erecta, operculo conico dimidio breviore, annulo e triplici serie cellularum composito, peristomio nullo.
Hab. N.W. America, *Douglas*.

In the absence of peristome, allied to the East Indian *B. rufescens*; but the present is a rather larger species, with more subulate leaves, not so straight, and stiffly appressed when dry; they are also more contracted at the base.

B. RIGIDULA, (Bryum) *Dicks*.
Hab. Vancouver Island, *Lyall*.

The specimens are too old and too young to show the peristome, but they appear to belong to this species.

B. FALLAX, *Hedw*.
Hab. Rocky Mountains, *Bourgeau*.

A barren moss, but which appears to belong to this species.

B. insulana, De Notaris, usually confused with *B. vinealis*, Brid., was gathered in California by Beechey.

B. RUBELLA, *Roth*.
Hab. Rocky Mountains, *Bourgeau*.

TORTULA, *Schreb*.

T. TORTUOSA, *Linn*.
Hab. Rocky Mountains, *Bourgeau*.

T. CORNICULATA, (Trichostomum) *Wahl.* Barbula anomala, *Bryol. Europ.*
Hab. Vancouver Island, *Lyall.*

One or two stems only; it was gathered in California by Dr. Coulter.

** *Syntrichiæ.*

PHASCUM, *Linn.*

P. CUSPIDATUM, *Schreb.*
Hab. Fort Colville, *Lyall.*

DESMATODON, *Brid.*

D. CAVIFOLIUS, (Pottia) *Ehrh.*
Hab. Fort Colville, *Lyall.*

D. HEIMII, (Gymnostomum) *Hedw.*
Hab. Saskatchewan, *Bourgeau.*

D. LATIFOLIUS, (Dicranum) *Hedw.*
Hab. Cascade Mountains, *Lyall.*

D. MUCRONIFOLIUS, (Tortula) *Schw.*
Hab. Rocky Mountains, *Bourgeau.*

SYNTRICHIA, *Brid.*

S. PRINCEPS, *De Not.* Barbula Mülleri, *B. et S.*
Hab. Vancouver Island, *Lyall.*

Some of the specimens very fine, and much larger than European ones. This species is widely distributed, and in appearance is very variable.

If De Notaris's name has priority in publication, it ought to take precedence.

S. RURALIS, *Linn.*
Hab. Rocky Mountains, Cascade Mountains, Fort Colville, and Moyie River (a branch of the Kootenay), *Lyall.*

This species is generally present in collections from very high northern latitudes.

S. LÆVIPILA, *Brid.*
Hab. Vancouver Island, *Lyall.*

A short compact state, but not apparently different from the European form. M. Lesquereux makes the same remarks upon the Californian specimens sent to him.

S. papillosa, Wils., has been sent from Boston intermixed with *Pterogonium intricatum*, Hedw.

ENCALYPTA, *Schreb.*

E. CILIATA, *Hedw.*
Hab. British Columbia, Cascade Mountains, and Fort Colville, *Lyall.*

E. VULGARIS, *Hedw.*
Hab. Fort Colville, *Lyall.*

E. RHABDOCARPA, *Schw.*
Hab. Rocky Mountains. Cascade Mountains, *Lyall.*

E. LONGIPES. Dioica?, caule brevi ramoso, foliis patulis concavis ambitu late ellipticis acutis paulo supra basin angustatis nervo percurrente obtuse carinatis, margine minute eroso, cellulis basi infima oblongis hyalinis inde viridibus mox abbreviatis quadrato-rotundatis papillosis, perichætialibus parvis vaginulam vix superantibus latissime ovatis acutis, theca in pedunculo longissimo rubro ovato-cylindracea basi apophysata, operculo subulato subæquilongo, peristomio dentibus angustis elongatis, calyptra basi nuda apice lævi.
Hab. In a shaded place by the side of a rivulet, Rocky Mountains, *Drummond.*

Stems about three lines high, with many fastigiate branches. Foliage like that of *E. streptocarpa*, to which species Drummond himself referred the specimens. Leaves gradually dilated from a little above the pale base, the upper portion broadly elliptic. Seta an inch and a half long, slightly flexuose. Capsule too immature to show if it is furrowed. Male flowers not seen.

MNIACEÆ, *Mitten.*

FISSIDENS, *Hedw.*

F. ADIANTOIDES (*Linn.*).
Hab. Fort Colville, *Lyall.*

F. GRANDIFRONS, *Brid.*
Hab. Sumass Prairie, British Columbia, *Lyall.*

TETRAPHIS, *Hedw.*

T. PELLUCIDA (*Linn.*).
Hab. Saskatchewan, *Bourgeau*; Fort Colville, *Lyall.*

AULACOMNION, *Schw.*

A. ANDROGYNUM (*Linn.*).
Hab. Vancouver Island and Fort Colville, *Lyall.*

A. PALUSTRE (*Linn.*).
Hab. Saskatchewan and Rocky Mountains, *Bourgeau*; Cascade Mountains, *Lyall.*

MNIUM, *Linn.*

M. INSIGNE, *Mitten.*
Hab. Vancouver Island, *Wood and Lyall*; British Columbia, *Lyall.*

M. MEDIUM, *B. et S.*
Hab. Pend Oreille and Pack Rivers, Fort Colville, and Cascade Mountains, *Lyall.*

M. AFFINE, *Bland.*
Hab. Saskatchewan and Rocky Mountains, *Bourgeau.*

M. VENUSTUM, *Mitten.*
Hab. Vancouver Island, *Lyall.*

M. CUSPIDATUM, *Hedw.*
Hab. Saskatchewan, *Bourgeau.*

M. SPINULOSUM, *B. et S.*
Hab. Fort Colville, *Lyall.*

M. UMBRATILE, sp. nov. Dioicum, foliis laxis patentibus, inferioribus minoribus oblongis ovalibusque plus minus acutis integerrimis marginatis, superioribus elliptico-oblongis apiculo parvo terminatis, basi longe decurrentibus, marginibus breviter duplicato-serratis, nervo percurrente, cellulis omnibus rotundatis parietibus grossiusculis, perichætialibus pluribus interioribus brevioribus lanceolatis, exterioribus elongatis, caulinis angustioribus, theca in pedunculo pallide rubro horizontali oblongo cylindracea basi attenuata curvata, operculo pallido conico acuminato, cæterum *M. serrato* simillimum.
Hab. "Mountain Rocks, Second point of Wood, Portage River," *Drummond*; Galton Mountains, British Columbia, *Lyall.*

In appearance altogether like *M. serratum*, Brid., and with foliage, as in that species, contorted and shrinking away when dry, but in its dioicous inflorescence allied to *M. orthorhynchum*, Brid., which was mixed with Drummond's specimens of his *Bryum marginatum*, no. 259; differing, however, from this in its softer leaves with cells four times as large, and also from *M. riparium*, Mitten (*M. lycopodioides*, Bryol. Europ.), which has its cells only half as large, and the comal leaves long and narrow.

TIMMIA, *Hedw.*

T. MEGAPOLITANA, *Hedw.*
Hab. Vancouver Island and Galton Mountains, British Columbia, *Lyall*; Saskatchewan, *Bourgeau.*

T. AUSTRIACA, *Hedw.*
Hab. Cascade Mountains and Pack River, British Columbia, *Lyall.*

HYPNUM, *Dill.*

(*Homalothecium et Camptothecium*, Schimp.)

H. NUTTALLII, *Wils.*

Hab. Vancouver Island, *Lyall*; California, *Coulter*; N.W. Coast, *Douglas.*

In its capsule completely intermediate between *H. sericeum* and *H. lutescens.*

H. LUTESCENS, *Hedw.*

Hab. Vancouver Island, *Lyall*: collected also by *Douglas.*

Specimens very large, and capsule rather longer than in the common European form.

H. ÆNEUM, sp. nov. Dioicum, foliis inferne ovatis sensim lanceolato-acuminatis plicatis, nervo infra apicem evanido, marginibus reflexis remote serrulatis, cellulis basi ad angulos pluribus parvis abbreviatis obscuris, superioribus elongatis angustis, perichætialibus elongatis erectis late lanceolatis apice subito subulatis serrulatis enerviis, theca in pedunculo scabro cylindracea inclinata curvata, peristomio interno processibus angustis perforatis ciliis tribus subæquilongis interpositis in membrana ad tertiam dentium longitudinis exserta, habitu omnino *H. lutescenti* simile.

Hab. Pend Oreille River, British Columbia, *Lyall.*

A single fertile stem with two capsules and a few stems with male flowers are all that has been seen of this moss; it resembles *H. aureum*, Lagasc., in size and general appearance, but the leaves of the stems are not so deeply plicate, and the apices lanceolate and serrulate, not attenuated into a smooth hair-like point. In the apices of the lateral branches the leaves have their points broad, somewhat acutate, and obtuse; by this particular the specimens are readily distinguished from *H. lutescens* as well.

H. NITENS, *Schreb.*

Hab. Saskatchewan, *Bourgeau*; Pack River, British Columbia, *Lyall.*

(*Ptychodium et Lescurea*, Schimp.).

H. RADICOSUM, sp. nov. Dioicum, intricate cæspitosum, foliis patentibus laxe imbricatis in apicibus ramorum subsecundis ovato-lanceolatis acuminatis concavis nervo percurrente, marginibus reflexis apice serrulatis, cellulis basi pluribus abbreviatis rotundatis, superioribus oblongis mollibus, paraphyllis parvis lanceolatis, perichætialibus magnis erectis convolutis elliptico-lanceolatis acuminatis, externis enerviis, internis ad medium tenuiter nervatis apice subserrulatis.

Hab. Banks of the Portage River, *Drummond*, no. 225 (*H. tenax*).

So far as can be seen in the incomplete specimens, which are

mixed with a fertile state of *H. uncinatam*, this species would appear to be a little larger than that found in the mountains of Switzerland and distributed by Schleicher as *Pterogonium striatum*, and since named by De Notaris *Lescurea insignis*; but in this the leaves are more concave.

The relative position of the species constituting the group known as *Lescurea*, Schimper, to *Ptychodium* ejusd. is precisely the same as that of *Pylaiesia*, Schimp., to *Hypnum cupressiforme* and of *Homalothecium* to *Camptothecium* and *Brachythecium*, the sum of the differences being only in a more erect capsule and less perfect peristome—distinctions which may serve for the arrangement of the species, but can scarcely be admitted as of generic importance when considered by the light afforded by the very natural group *Plagiothecium* and *Amblystegium*, Schimp., and also by the modifications in the peristome of *Bryum*.

All the yet described species of *Lescurea* and *Ptychodium* agree in the substance of the leaves and in the presence of paraphylla.

(*Brachythecium*, Schimp.)

H. ALBICANS, *Neck.*
Hab. Rocky Mountains, *Bourgeau.*

H. SALEBROSUM, *Hoffm.*
Hab. Saskatchewan, *Bourgeau*; Fort Colville and Pend Oreille River, *Lyall.*

H. COLLINUM, *Schleich.*
Hab. Cascade Mountains, British Columbia, *Lyall*; collected also in British N. America by *Drummond.*

H. ŒDIPODIUM, sp. nov. Monoicum, caule procumbente subpinnato ramis decurvis radicantibus, foliis late ovatis acuminatis, nervo medio evanido, marginibus serrulatis, cellulis oblongis elongatisque ad angulos decurrentibus pluribus quadratis, perichætialibus convolutis late ellipticis acuminatis apice serrulatis enerviis, theca in pedunculo crassiusculo sulcato minute scabro nutante ovali inæquali, operculo conico, peristomio normali ciliis duobus appendiculatis.
Hab. Lake Huron, *Todd,* and sent from the United States by *Cooley*; Pack River and Rocky Mountains, *Lyall.*

Stems loosly cæspitose. Leaves pale green and subcompressed, those of the ramuli more sharply serrulate; areolation soft and loose; cells generally chlorophyllose. In appearance this species has some resemblance to *H. Starkii*, and agrees with it in its thick seta and the appearance of the capsule; but the substance of the leaves is far different, and in drying they do not become striated.

H. DECLIVUM, sp. nov. Monoicum, caule procumbente subpinnato, foliis subfalcatis lanceolatis sensim acuminatis, nervo medio evanido, marginibus serrulatis, cellulis omnibus elongatis angustis, perichætialibus e basi latiore recurvis enerviis, theca in pedunculo crassiusculo scaberrimo horizontali ovali inæquali, operculo conico, peristomio normali ciliis duobus appendiculatis

Hab. Pend Oreille River, on *Peltigera scutata* and *P. venosa*, *Lyall.*

A small, slender species, so nearly allied to *H. velutinum*, Dill., that it might be considered merely a variety, were it not for the very much thicker and more scabrous seta and the capsule, when old, pendulous.

H. ACUTUM, sp. nov. Monoicum, caule procumbente vage subpinnato, foliis patentibus compressis ovato-lanceolatis sensim a basi ad apicem acutum angustatis siccitate longitudinaliter plicatis, nervo paulo ultra medium evanido, marginibus superne remote serrulatis, cellulis basi brevibus oblongis inde ad apicem elongatis angustis, perichætialibus e basi erecta ovali brevi nervata subulatis angustis subintegerrimis recurvis, theca in pedunculo elongato ovali inclinata inæquali, operculo conico brevi subulirostrato, peristomio normali.

Hab. Pack River, British Columbia, *Lyall.* Sent also from Boston by *Green.*

In size and general appearance very closely resembling some of the less robust states of *H. salebrosum*, but differing from this and nearly all the allied species in the form of its leaves gradually narrowed from just above the base to the apex and not acuminate, and in the operculum. In the compressed foliage and spreading habit not very dissimilar to some states of *H. riparium*, Dill.

H. ASPERRIMUM, sp. nov. Dioicum, caule procumbente ramis laxe subpinnatim ramosis, foliis ovatis sensim acuminatis striatis, nervo ultra medium evanido dorso denticulato, marginibus serrulatis basi anguste decurrentibus, cellulis ad angulos paucis brevioribus, superioribus elongatis angustissimis, perichætialibus e basi ovata subulato-attenuatis recurvis breviter nervatis, theca in pedunculo elongato asperrimo inclinata ovali, operculo conico acuminato, peristomio normali.

Hab. British Columbia, *Lyall and Douglas.*

A little more slender than the usual forms of *H. rutabulum*, Dill., and with leaves gradually narrowed to the apex, not contracted at the top of the ovate portion of the leaf, thence acuminate, the margins more strongly serrulate, and the nerve distinctly denticulate towards its apex.

(*Isothecium*, Bryol. Europ.)

H. STOLONIFERUM, *Hook. Musci Exot.* t. 74.

Hab. Vancouver Island, *Wood*; British Columbia, *Lyall*; N.W. America, *Menzies*; Nootka, *Barclay*.

Leaves from the primary stem, where the perichætia are produced, ovato-lanceolate, serrulate, slightly plicate, those of the ramuli elliptic-lanceolate, minutely papillose on the back above the middle, nerve smooth, continuing to three-fourths of the length of the leaves. Perichætial leaves subulate, serrulate, and recurved, from an oblong, erect, faintly two-nerved base. Seta smooth. Peristome as figured. This fine species corresponds entirely in habit with the European *H. myosuroides*, Dill.

H. SPICULIFERUM, sp. nov. Foliis infra perichætium e basi cordato-ovata lanceolato-acuminatis nervo ad $\frac{3}{4}$ evanido dorso lævibus, marginibus inferne reflexis superne serrulatis, superioribus angustioribus dorso papillosis, ramulinis elliptico-lanceolatis acutissimis concavis dorso spiculoso papillosis, nervo versus apicem denticulato, marginibus planiusculis ubique serrulatis, perichætialibus e basi erecta oblonga ultra medium uninervatis subulatis serrulatis recurvis, theca in pedunculo breviusculo lævi oblonga subæquali horizontali, operculo conico, peristomio interno processibus perforatis, ciliis singulis æquilongis, in membrana ad tertiam dentium longitudinis exserta, habitu *H. myosuroidis*.

Hab. British Columbia, *Lyall and Douglas*.

In habit similar to *H. myosuroides*, but the ramuli more attenuated and more curved, and the whole plant a little larger. It appears to differ from *H. stoloniferum* in its more slender habit, more abundant papillæ on its branch leaves, reflexed margin of its cauline leaves, the more strongly one-nerved perichætial leaves, and single cilium between the processes of the internal peristome.

H. ACUTICUSPIS, sp. nov. Foliis laxe imbricatis, infra perichætium late cordato-ovatis acumine angusto elongato marginibus tenuiter serrulatis apice cuspidis sublævi, nervo variante brevissimo, quasi disperso, furcato integrove medio evanido, cellulis ad angulos impressis infuscatis, ramulinis ovali-ellipticis acutis serrulatis ad medium nervatis dorso lævibus, cellulis ad angulos fuscis, perichætialibus e basi oblonga enervia subulatis recurvis subintegerrimis, theca in pedunculo breviusculo ovali inclinata, operculo conico, peristomio interno processibus perforatis ciliis duobus brevioribus interpositis, habitu *H. stoloniferi*.

Hab. British Columbia, *Douglas*.

Two stems only have been seen of this apparently distinct species. In size it corresponds with *H. stoloniferum*; but its

leaves are much wider in proportion to their length, and loosely imbricated, so that the stems have a more terete appearance; the papillæ on the back of the leaves seem to be absent; the areolation agrees entirely with that of the preceding species, but the cells in the angles are more bossed out and coloured.

This may be *H.* (*Isothecium*) *Brewerianum*, Lesq., but its description is not sufficiently complete to be quite certain.

H. aggregatum, sp. nov. Dioicum, caule primario repente, ramis erectis densissime aggregatis simplicibus parceve ramosis curvatis attenuatis, foliis inferioribus patentibus late hastato-ovatis acuminatis subenerviis sensim versus medium ramorum in late ovata, ultra medium nervata acuminata subjulacea imbricata transeuntibus, inde sensim minoribus argutiusque versus apicem serrulatis, nervo dorso apice dentiformi prominente, cellulis ad angulos pluribus minutis quadrato-rotundatis, superioribus brevibus oblongis pellucidis, perichætialibus elongatis ovato-lanceolatis seminerviis apicibus serrulatis patulis, theca in pedunculo circiter semiunciali lævi inclinata cylindracea inæquali, operculo conico acuminato, peristomio interno processibus angustis, ciliis singulis dimidio brevioribus interpositis, in membrana ad dentium tertiam longitudinis exserta.

Hab. Vancouver Island, *Lyall*; British Columbia, *Douglas*.

Slightly glossy, pale green tinged with brown, growing in dense patches, with the erect stems closely packed together. The leaves, from their julaceous imbrication, give the smaller plants some resemblance to some states of *Pterogonium gracile*, but they are generally much thicker and shorter. Other stems with less imbricated leaves have a resemblance to *H. myurum*, with which the habit of the plant agrees.

H. aplocladum, sp. nov. Dioicum, caule procumbente apice descendente radicante ramis paucis subsimplicibus apicibus sæpe attenuatis decurvatis, foliis patentibus, in ramorum apicibus cuspidato-imbricatis, ovatis acutis nervo sub apice evanido integerrimis, in ramulis apicibus latioribus obtusioribus serrulatis, cellulis basi ad angulos pluribus quadrato-rotundatis subobscuris, superioribus oblongis parietibus teneris, perichætialibus elongatis erectis ovato-lanceolatis acuminatis apice serrulatis ultra medium nervatis, theca in pedunculo elongato sublævi erecta suberectave ovali cylindracea, operculo convexo acuminato.

Hab. N.W. coast of America, *Douglas*.

In appearance not unlike some specimens of *H. acuminatum*, Beauv.; but the leaves are quite smooth, and the habit would appear to be different. The seta is very slightly rough, so slightly that its roughness is only seen when specially sought for. The peristome is broken in all the capsules.

H. LENTUM, sp. nov. Dioicum, foliis patentibus laxe imbricatis, in apicibus ramorum cuspidato-imbricatis, inferioribus latioribus brevioribus in ramorum medio ubi fructus proferunt late ovatis acumine brevi, in ramulis attenuatis ovato-lanceolatis apicibus latioribus obtusioribus, marginibus tenuiter in ramulinis argutius serrulatis nervo ultra medium evanido, cellulis basi ad angulos pluribus latioribus angustioribus immixtis parietibus crassiusculis, superioribus angustis, quasi apicibus dorso prominulis, in apice oblongis, perichætialibus enerviis e basi ovali amplexante subulatis recurvis subintegerrimis, theca in pedunculo unciali scabro ovali cylindracea suberecta inæquali, peristomio interno processibus solidis ciliis singulis subæquilongis in membrana ad dentium tertiam longitudinis exserta.

Hab. N.W. coast of America, *Douglas.*

Of this moss only a few fragments have been seen. It appears to be about the size of the common forms of *H. myurum*, but of a loose spreading habit.

At first it was supposed that this was only a state of *H. aplocladum*; but the decidedly rough seta and wider leaves, those of the perichætium spreading, render it distinct. The scabrous seta of this moss may be considered a new feature in the group of species to which it is here referred: but after a consideration of the characters which constitute the group *Isothecium*, it becomes evident that it cannot be defined distinctly from the groups named by Schimper *Brachythecium* and *Scleropodium*; for the habit, which is the most evident characteristic of *Isothecium*, is only more conspicuous among the species forming that group than it is in *Brachythecium*, in which it is essentially the same; and the only difference between these groups is the plication of the leaves, chiefly when dry, in the group *Brachythecium*, which in *Isothecium* and *Scleropodium* is less evident, and is thus a transition to the group *Rhynchostegium*, which have the leaves more smooth.

(*Eurhynchium*, Schimp.)

H. OREGANUM, *Sullivant, in U. S. Expl. Exped.* t. 13. H. Douglasii, *Hook. MS.*

Hab. British Columbia, near the 49th parallel, *Lyall*; Vancouver Island, *Wood.*

Some specimens of this noble species were more than a foot long.

H. PRÆLONGUM, *Dill.* H. Stokesii, *Turn.*

Hab. British Columbia, near the 49th parallel, *Lyall*; Vancouver Island, *Lyall and Wood.*

This much misunderstood species has a very wide distribution, and is found in the Andes.

H. STRIGOSUM, *Hoffm.*

Hab. Rocky Mountains, *Bourgeau*; Fort Colville and Galton Mountains, *Lyall.*

PTEROGONIUM, *Sw.*

P. BRACHYPTERUM, sp. nov. Monoicum, caule procumbente inordinate pinnato ramis abbreviatis, foliis imbricatis densis late deltoideo-ovatis acuminatis (acumine angusto) concavis, margine inferne plano superne minute subserrulato, nervo concolore paulo ultra medium evanido, cellulis ad angulos minutis rotundis, reliquis brevi-ovoideis in apiculi apice elongatis, omnibus distinctis papillosis, perichætialibus erectis ovatis acuminatis nervo supra medium desinente integerrimis, cellulis elongatis areolatis teneris, theca in pedunculo elongato crassiusculo flavo ovali-cylindracea erecta æquali, operculo brevi conico, peristomio externo dentibus brevibus flavis infra os thecæ orientibus basi coalitis, interno carente, flore masculo gemmiformi majusculo.

Hab. British North America, *Drummond.*

Stems about one inch long. Seta half an inch high. In structure and appearance corresponding closely with the Abyssinian *P. abbreviatum*, (*Leskea*) Schimp. Quite distinct from any other North American moss.

(*Heterocladium*, Schimp.)

P. PROCURRENS. Dioicum, caule arcuato procumbente ramis inordinatis pinnato bipinnatove, foliis caulinis divergentibus compressis cordato-ovatis sensim in acumen piliforme attenuatis marginibus tenuiter serrulatis nervis binis inæqualibus medio evanidis, cellulis in folii medio elongatis margines apicemque versus oblongis, omnibus pellucidis lævibus, rameis ovatis asymmetricis apicibus obtusiusculis, perichætialibus e basi late ovata convoluta apicibus patentibus, theca in pedunculo elongato ovali horizontali.

Hab. British N. America, *Drummond.*

Dull yellowish green. Stems three inches or more long, with branches varying from half to one inch in length. Seta one inch long. This species has a looser habit than the European *H. dimorphum*, Brid., and *H. Kurrii*, Sch., but agrees with them in all essential characters. It is the largest of all the species yet known.

HYLOCOMIUM, *Schimp.*

H. TRIQUETRUM, *Linn.*

Hab. British Columbia, *Lyall and Douglas*; Juan de Fuca, *Seemann.*

H. LOREUM, *Dill.*

Hab. Vancouver Island, *Lyall and Wood*; British Columbia, *Lyall*; N.W. Coast, *Barclay*; Juan de Fuca, *Seemann.*

H. SPLENDENS, *Dill.*
Hab. Saskatchewan, *Bourgeau*; Vancouver Island, *Lyall and Wood*; British Columbia, *Lyall.*

Hypnum spectabile, Wils. MS., from Russian America, is probably *H. Ruthenicum,* Weinmann, Syll. Musc. Frond.; and his comparison of his specimens with Hedwig's figure of *Leskea filiculiformis,* Sp. Musc. t. 50, is most just and almost conclusive, for it gives a good idea of the size and appearance of the species even better than it does of the *Hypopterygium* for which it was intended.

CLIMACIUM, *W. et M.*

C. DENDROIDES, *Linn.*
Hab. Pend Oreille River, British Columbia, *Lyall.*

NECKERA, *Hedw.*

N. MENZIESII, *Hook. et Wils.*
Hab. Fort Colville, British Columbia, *Lyall.*

An authentic specimen in Sir W. Hooker's herbarium proves the *Mnium heteropterum* mentioned by Dr. Sibthorp in the 'Flora Græca' to be this moss,—at least so far as can be ascertained without fructification, in which in this tribe there is frequently a greater difference than in any other part of the plant.

N. DOUGLASII, *Hook.*
Hab. Vancouver Island, *Wood*; British Columbia, *Lyall.*

HOMALIA, *Brid.*

H. OBTUSATA, *Mitten, Musci Ind.*
Hab. British Columbia, *Lyall.*

A few imperfect specimens, apparently identical with the Indian species, which differs from *H. trichomanoides,* Schreb., in its more obovate leaves more rounded at their apices, the nerve sometimes imperceptible, and the cells in the apex shorter.

THAMNIUM, *Schimp.*

T. NECKEROIDES, (Hypnum) *Hook. Musc. Exot.* t. 58.
Hab. Vancouver Island, *Wood.*

One species only is enumerated by Sullivant in the United States, *T. Alleghaniense,* C. Müller; but there are the specimens of *T. neckeroides* collected by Drummond near St. Louis, no. 119; and *T. alopecurum,* (*Hypnum*) Linn., was sent from Boston by Green.

STEREODON, *Brid.*

(*Plagiothecium*, Schimp.)

S. PULCHELLUS, *Hedw.*
Hab. Fort Colville, *Lyall.*

These specimens correspond with authentic examples of *S. pulchellus* of the 'Bryologia Europæa.' But it appears very difficult to assign any constant character to *S. nitidulus*, viewed as a distinct species; for, besides these forms, there is a third, collected in Davis's Straits by Mr. Taylor, and also creeping amongst some of Drummond's specimens of *Webera longicolla*; it has its leaves about half as wide again as in *S. pulchellus*, but no other decided difference.

S. TURFACEUS, *Lindbg.*
Hab. Fort Colville, British Columbia, *Lyall.*

This very distinct species will doubtless in time be found in British North America.

S. GEMINUS, sp. nov. Monoicus, ramis assurgentibus intertextis, foliis ovatis ovato-acuminatisque patulis varie decurvis subsecundis subfalcatisve marginibus minute serrulatis subintegerrimisve nervis latis usque ad medium productis, cellulis angustis elongatis basi paucis brevioribus, perichætialibus erectis internis longioribus latis breviter acuminatis, theca in pedunculo elongato ovali-cylindracea suberecta collo sensim attenuato, peristomio interno processibus angustis ciliis binis subæquilongis interpositis.

Hab. Rocky Mountains, alt. 6000–8000 feet, associated with *S. pulchellus* and *Mnium umbratile*, Mitten, *Lyall.*

Somewhat similar to *S. pulchellus*, Hedw., but with leaves more gradually narrowed from a wider base, the thin but wide nerves continued to about the middle, the margin more or less evidently serrulate from the base to the apex, and the cells only half as long and narrower.

S. DONIANUS, *Sm.*
Hab. Fort Colville, *Lyall.*

S. UNDULATUS, *Hedw.*
Hab. Fort Colville, *Lyall.*

(*Orthothecium*, Schimp.)

S. CHRYSEUS, (Hypnum chryseon) *Hornsch.*
Hab. Rocky Mountains, *Bourgeau and Drummond*, no. 221.

This species has been brought from Beechey Island, Wellington Channel, and Pond's Bay, in Arctic America, by Dr. Lyall, but, excepting Drummond's specimens, all are without fruit.

S. rufescens, Dicks., in a small state, was collected in Davis's Straits by Mr. Taylor; and from the same region he brought another species, which will certainly be found in Europe when carefully sought for. It may be characterized thus:—

S. RUBELLUS, sp. nov. Dioicus, cæspitosus, ramis erectis parce ramosis, foliis imbricatis ovatis concavis apiculo brevi flexuoso marginibus revolutis nervis binis brevissimis, cellulis elongatis alaribus inconspicuis, perichætialibus imbricatis ovato-lanceolatis.

Hab. Davis's Straits, *Taylor*; Rocky Mountains, *Drummond*, intermixed with *Catoscopium nigritum*, Hedw. Sassar Pass, Nubra Mountains, Tibet, alt. 16,000–17,000 feet, *Thomson*.

A small moss, with all the habit, appearance, and colour of *Orthothecium intricatum*, Bryol. Europ., but differing in its almost exactly ovate leaves, with a short, sometimes discoloured apiculus, the margins revolute, and the areolation composed of cells which are twice as wide. In the same particulars it differs from *O. rufescens* and *O. chryseum*.

(*Pylaiesia*, Schimp.)

S. POLYANTHUS, *Schrad.*

Hab. Saskatchewan and Rocky Mountains, *Bourgeau*.

This moss appears to be abundant in British America.

(*Drepanium*, Schimp.)

S. REPTILIS, *Mich.*

Hab. Kootenay River, British Columbia, *Lyall*.

S. PLICATILIS, sp. nov. Dioicus, fastigiate ramosus, foliis falcatis secundis late ovatis acuminatis hamatis siccitate ruguloso-subplicatis, nervis brevibus, marginibus reflexis integerrimis, in ramulinis apice serrulatis, cellulis ad angulos pluribus abbreviatis parvis obscuriusculis, superioribus latitudine $\frac{1}{6000}$ longitudine $\frac{5-8}{6000}$ circiter unciæ metientibus parietibus tenuibus, perichætialibus erectis elongatis internis late oblongo-lanceolatis apice subulatis integerrimis plicatis, theca in pedunculo elongato cylindracea basi erecta medio curvata, operculo conico, peristomio interno processibus luteis perforatis ciliis binis æquilongis nodulosis interpositis.

Hab. Davis's Straits, *Taylor*; Rocky Mountains, *Bourgeau*. Also the "*Hypnum cupressiforme β. compressum*," Sweden, *Sommerfeldt*, in Herb. Hooker, appears to be the male plant, but is much less than any of the American specimens.

In size and general appearance the few specimens yet seen of this moss resemble *Hypnum callichroum*, Brid., and are pale yellowish green, the older parts brown; it differs from all the states of *H. cupressiforme* in the strongly reflexed margins of its leaves and short cells.

S. CIRCINALIS, *Hook. Musc. Exot.* t. 107.
Hab. Vancouver Island, *Lyall.*

S. PLUMIFER, sp. nov. Dioicus, cæspitosus, ramis procumbentibus, ramulis approximatis plumiformi-pinnatis, foliis falcatis secundis e basi latiore subovato-lanceolatis sensim tenuiter angustatis hamatis siccitate subplicatis, nervis tenuibus brevibus, marginibus inferne reflexis integerrimis, in ramulinis apice serrulatis, cellulis ad angulos paucis abbreviatis subobscuris, superioribus elongatis angustis, perichætialibus elongatis erectis pallidis late lanceolato-subulatis apicibus serrulatis, theca in pedunculo elongato longe cylindracea suberecta curvata, operculo brevi subulato rostrato, peristomio dentibus pallidis teneris, interno tenero processibus latiusculis perforatis ciliis binis æquilongis angustis interpositis in membrana alte exserta.
Hab. N. America, *Drummond*; Canada, *Shepherd*; Columbia, *Douglas*; N.W. coast of America, *Douglas and Menzies*; Pack River, *Lyall.* Very common on trees and on the ground in British Columbia, *Lyall*; Vancouver Island, *Lyall.*

Shining yellowish green, becoming in age pale brown, more slender than *H. imponens*, and in habit approaching more to *H. crista castrensis.* In its narrow glossy leaves, long curved capsule, and rostrate operculum it is sufficiently distinct from *H. imponens* and *H. hamulosum.* This may be the *H. subimponens*, Lesq.; but the operculum is different from that described in the short account of the species.

S. CRISTA CASTRENSIS, *Linn.*
Hab. Saskatchewan, *Bourgeau.*

S. ROBUSTUS, *Hook. Musc. Exot.* t. 108.
Hab. Fort Colville and Pack River, *Lyall.*

Very few specimens, which give no further information as to the habit of the species.

Belonging to this group are also—

S. COMPLEXUS, sp. nov. Dioicus, late cæspitosus, ramis pinnatis, foliis secundis e basi latiore ovato-lanceolatis hamatis concavis nervis binis brevibus marginibus subintegerrimis, cellulis ad angulos pluribus abbreviatis subquadratis obscurioribus, superioribus elongatis angustis apicibus quasi prominulis, perichætialibus elongatis erectis oblongis subulatis, internis lanceolatis subito subulatis subserrulatis plicatis, theca in pedunculo rubro cylindracea inæquali inclinata, peristomio dentibus flavis e medio subulatis, interno processibus angustis ciliis binis interpositis.
Hab. On rocks between Fort William and Cumberland House, British N. America, *Richardson.*

In large interwoven patches of a dull-green colour. In general appearance very similar to that form of *H. cupressiforme* known as "*tectorum*," but its affinity is in other respects with *H. reptile*, Mich., in the form and especially the substance of its leaves, and in the plication of those of the perichætium; but the present species is certainly dioicous, more robust, and with scarcely serrulate leaves.

S. CIRCULARIS, sp. nov. Caule rufescente fastigiate ramoso, foliis secundis circinatis ovato-lanceolatis apice angustis acutis, breviter binervatis marginibus basi tantum subserrulatis, cellulis ad angulos paucis abbreviatis subobscuris flavidis, superioribus elongatis latitudine $\frac{1}{6000}$ longitudine $\frac{10-12}{6000}$ circiter unciæ metientibus pellucidis.

Hab. Beechey Island and Wellington Channel, *Lyall.*

Pale yellowish green slightly tinged with brown. Stems one or two inches high; branches irregularly disposed, fastigiate; leaves all circinate, and so closely directed to the ventral side of the stem as to be laterally compressed. In general appearance and size nearest to *H. callichroum*, Brid., but the areolation of the base of the leaf is different.

(*Limnobium*, Schimp.)

S. OBTUSIFOLIUS, *Hook. et Wils.*

Hab. Poseidon River, *Lyall.*

A few specimens, all without fruit.

S. ARCTICUS, *Sommerf.*

Hab. Rocky Mountains, *Lyall.*

S. OCHRACEUS, *Turner.*

Hab. Cascade Mountains, British Columbia, *Lyall.* This moss is found also in Davis's Straits; and a few fragments of *S. turgescens*, Schimper, were also obtained there by Mr. Taylor.

(*Cuspidaria*, C. Müller.)

S. SCHREBERI, *Willd.*

Hab. Saskatchewan, *Bourgeau.*

This species does not well range here.

S. CUSPIDATUS, *Linn.*

Hab. Pack River, *Lyall.*

S. RICHARDSONI, sp. nov. Monoicus, cæspitosus, ramis inordinatim pinnatis apice cuspidatis, foliis patentibus late ovatis apice rotundatis obtusis concavis integerrimis nervo medio evanido, ramulinis oblongo-lanceolatis obtusis, cellulis elongatis apicibus prominulis alaribus laxis ventricosis pallidis, perichætialibus ovalibus acutis lævibus imbricatis

seminerviis, theca in pedunculo elongato rubro cylindracea arcuata horizontali, peristomio normali.

Hab. N. America, *Richardson.* Supposed by Drummond to be from the Great Bear Lake. Coast of Greenland, Baffin's Bay, *Inglefield.*

The general appearance and yellowish-brown colour of this species is closely similar to that of *H. cuspidatum,* and it is intermediate between it and *H. cordifolium.*

S. GIGANTEUS, *Schimp.*
Hab. Fort Colville, *Lyall.*

This is the species distributed as *H. cordifolium* by Drummond, no. 209, but all the American examples are more slender than European specimens.

(*Campylium,* Schimp.)

S. CHRYSOPHYLLUS, *Brid.*
Hab. Saskatchewan, *Bourgeau.*

S. HISPIDULUS, *Brid.*
Hab. Mooyie River, *Lyall.*

(*Amblystegium,* Schimp.)

S. COMPACTUS, *Bruch et Schimp.*
Hab. Near Fort Colville, *Lyall.*

S. RADICALIS, *Beauv.*!
Hab. Saskatchewan, by the river near Fort Ellice, *Bourgeau*; Pack River, Galton Mountains, and Cascade Mountains, *Lyall.*

This much misunderstood species differs from *S. serpens,* Linn., in its narrower and longer leaf-cells; it occurs in Europe, but is confused with the following species.

S. VARIUS, (Leskea) *Hedw.*
Hab. Saskatchewan, *Bourgeau*; Pend Oreille River, *Lyall.*

S. RIPARIUS, *Linn.*
Hab. Saskatchewan and Rocky Mountains, *Bourgeau.*

S. KNEIFII, *B. et S.*
Hab. Rocky Mountains, *Lyall*; Saskatchewan, *Bourgeau.*

S. UNCINATUS, *Hedw.*
Hab. Cascade, Galton, and Rocky Mountains, *Lyall.*

S. VERNICOSUS, *Lindbg.*
Hab. Pack River, *Lyall.*

S. FILICINUS, *Linn.*
Hab. Saskatchewan, *Bourgeau*; Mooyie River, *Lyall.* The variety *Vallis-Clausæ* in running water, Fort Colville, *Lyall.*

S. COMMUTATUS, *Hedw.*
Hab. Rocky Mountains, *Bourgeau.*

FONTINALACEÆ, *Schimp.*

DICHELYMA, *Myrin.*

D. UNCINATUM, sp. nov. Foliis tristichis falcatis secundis lanceolatis sensim longe tenuiter angustatis complicatis nervo excurrente apice denticulato marginibus e medio ad apicem minute serrulatis, cellulis elongatis angustis, perichætialibus convolutis externis oblongis obtusis internis elongatis acutioribus, theca in pedunculo brevi exserta ovali interdum inæquali, operculo subulato subæquilongo, peristomio interno toto cancellato externo paulo longiore, habitu *D. falcati.*

Hab. Fort Colville, British Columbia, *Lyall.*

Rather more slender than *D. falcatum,* Myrin, and its stems more subpinnate; its leaves more setaceous from the excurrent nerve, which is smooth beyond the serrulate margins and denticulate only at its apex. The perichætial leaves are not twisted; and the internal peristome, which resembles a perfect cancellate cone, only exceeds the external teeth by about one-fifth of their length.

Male plants of *D. falcatum* have sometimes leaves with narrow points, but it is difficult to see if the nerve is continued into them, or if they are merely a prolongation beyond it, as is common in many mosses. The calyptra is not adherent by its base in any of the specimens of *D. uncinatum.*

FONTINALIS, *Dill.*

F. ANTIPYRETICA, *Linn.*

Hab. On stones in the river, Fort Colville, British Columbia, *Lyall.*

Appears to be identical with the European species.

F. SQUAMOSA, *Linn.*

Hab. Saskatchewan, *Bourgeau.*

LESKEA, *Hedw.*

(*Leskea.*)

L. POLYCARPA, *Ehrh.*

Hab. British Columbia, Pend Oreille River, *Lyall.*

(*Thuidium,* Schimp.)

L. GRACILIS, *B. et S.*

Hab. Saskatchewan, *Bourgeau.*

This is probably *Hypnum* (*Stereodon*) *Virginianum,* Brid.

L. ABIETINA (*Linn.*).

Hab. Lake Winnipeg, *Bourgeau.*

L. BLANDOVII (*Web. et Mohr*).

Hab. Fort Colville, *Lyall.*

L. DELICATULA (*Linn.*).
Hab. Saskatchewan, *Bourgeau.*

L. CRISPIFOLIA, *Hook. Musci Exot.* t. 31.
Hab. British Columbia and Pend Oreille River, *Lyall*; Vancouver Island, *Wood.*

TRACHYPUS, *Schw.*

T. NIGRESCENS, (Neckera) *Sw.*
Hab. Lake Huron, in fruit, *Todd*; also sent from Canada West, *Emery*, in Herb. Miles.

The occurrence of this species (which seems to be precisely the same as Swartz's, from a specimen in Herb. Hooker.) in a country so much further north, was at first regarded with some suspicion, but this is now entirely removed by the specimens recently collected by Mr. Emery.

LEUCODONTACEÆ, *Mitten, Musci Ind.*

HEDWIGIA, *Ehrh.*

H. CILIATA, *Ehrh.*
Hab. Mooyie River (a branch of the Kootenay), British Columbia, *Lyall.*

HEDWIGIA PILIFERA, sp. nov. Monoica, ramis ascendentibus laxe cæspitosis dichotome divisis ramulis superioribus abbreviatis, foliis subsecundis ovatis ovato-acuminatisque acumine diaphano, foliis ramulinis (flagelliformibus) pilo longo flexuoso terminatis marginibus integerrimis revolutis, cellulis parvis breviter oblongis inferioribus paululo longioribus basi fuscis dorso papillosis, perichætialibus erectis longioribus ovato-lanceolatis, theca in pedunculo gracillimo trilineari subglobosa ætate evacua sub ore amplo contracta circiter decemplicata, calyptra elongata cucullata fusca lævi.
Hab. Vancouver Island, on rocks, *Lyall.*

A little more slender than *H. ciliata*, Ehrh., but agreeing very nearly with it in general appearance. The younger portions of the stems are of a yellowish green, the older brown. The fruitstalk is very slender and pale red. The capsules, which are all old and empty, are contracted below the mouth, and the fruitstalk is affixed to their base without an attenuated neck.

This species has been here referred to *Hedwigia*, although it belongs to that small group of species which has been named by M. Schimper *Hedwigidium*, differing from *Hedwigia*, as originally founded by Ehrhart on *H. ciliata*, in the more cucullate calyptra and the presence of flagelliform shoots; these last are represented in *H. pilifera* by short ramuli, with leaves having very long hair points, but in all the specimens these ramuli are not decurved,

nor would they be distinguishable from the others except by their leaves. The capsule of *H. pilifera* and *H. imberbis* is plicate when old, but this character is observable in *H. Humboldtii*, Hook., which is considered by M. Schimper to present distinctions sufficient to constitute another genus, *Harrisonia*, and, according to him, to be placed amongst the pleurocarpous mosses; but there is no real difference in the position of the fertile flower in any of the species; and the distinctions upon which these genera have been propounded, when considered in connexion with those existing between the species of eminently natural genera, such as *Orthotrichum* and *Fissidens*, seem to be merely specific. The original position of the fertile flower appears to be terminal on the branches, which, producing innovations from immediately below it, render it apparently lateral in the more branched species.

Among the species included in the genera *Hedwigia*, *Hedwigidium*, *Braunia*, and *Harrisonia*, there is the closest affinity in the structure of the leaves and in the mode of growth, excepting that *H. ciliata* is destitute of flagelliform branches. In the form of the capsule there is considerable diversity; in *Hedwigidium* and *Harrisonia* it is short and plicate, in *Braunia* it is elongate and smooth. In all these genera the calyptra is elongate and cucullate, in *Hedwigia* it is short and mitriform; but the value of the genera distinguished by these characters is destroyed when compared with other groups of species forming the most natural genera, *Orthotrichum* and *Grimmia*. In the first there is as great a diversity in the form and plication of the capsule, and in the second as much difference in the calyptra of species in most other respects so very closely resembling each other, that more confusion would arise in dividing them on the strength of that character alone than in leaving them together. The distinctions therefore between the *Hedwigiæ*, measured in comparison, are rather of a sectional and specific nature than generic, and the mere multiplication of genera serves no useful purpose.

The position of the species composing the group here understood as *Hedwigia* has been variously estimated by authors. Müller places them amongst his Hypnoid mosses, *H. ciliata* in his *Pilotrichum*, and the residue in the section *Pterygynandrum* of his interpretation of the genus *Neckera*. Schimper places them, excepting *H. Humboldtii*, between his families *Grimmiæ* and *Ptychomitriæ*; but the affinity between some forms of *Grimmia* and *Hedwigia ciliata* is less than that existing between the flagelli-

ferous *Hedwigiæ* and *Leucodon sciuroides*, which produces flagella of exactly the same kind as those of *H.* (*Braunia*) *sciuroides*. In *Cryphea* there are several species which closely resemble *H. ciliata* and *H. imberbis*, having their fruit terminal on their branches, and immersed in a similar manner. There is also a great resemblance between the more branched *Hedwigiæ* and *Antitrichia curtipendula*, Brid., which also produces the same kind of flagella, and is in reality itself only a *Leucodon* with a more completely developed peristome, and improperly separated from that genus.

Since the foregoing description of this moss was written, there has appeared, in the Transactions of the American Philosophical Society, Mr. Lesquereux's description of *Braunia Californica*, which, in so far as can be generally gathered from the description, would appear to indicate the same species. On consideration, however, as there are some discrepancies, it has been thought best to let the description of *H. pilifera* stand, and to point out the differences which exist between Dr. Lyall's specimens and Mr. Lesquereux's description. They are, in our specimens, the stems not "vel simplicibus vel irregulariter innovando ramosis," nor "apice incrassatis duris;" the perichætial leaves not "brevioribus," but elongated, and the capsule plicate—in fact it is just the capsule of *H. imberbis* on an elongated pedicel. Mr. Lesquereux says that his species has a capsule "exactly top-shaped" when deoperculate, but nothing about the plication so evident in our specimens.

Antitrichia, *Brid.*

A. curtipendula, *Linn.*

Hab. Vancouver Island, *Wood*; British Columbia, *Lyall and Douglas.*

Very different in external appearance from the usual European states; but there seems to be no sufficient distinction between these specimens and the form which has a more slender habit and elongate capsules, enumerated by Schimper as var. β. *Hispanica*. Some of the specimens are very slender.

Spiridens, *Nees.*

S. abietinus, *Hook. Musc. Exot.* t. 7.

Hab. British Columbia, *Lyall, Douglas, and Menzies.*

POLYTRICHACEÆ.

Buxbaumia, *Haller.*

B. aphylla, *Haller.*

Hab. Cascade Mountains, British Columbia, *Lyall.*

Atrichum, *Beauv.*

A. undulatum (*Linn.*).
Hab. Fort Colville, *Lyall.*

A. parallelum, sp. nov. Dioicum?, caulibus breviusculis, in fertilibus foliis superioribus ligulato-lanceolatis, basi pro spatio oblongo inferne cellulis oblongis superne rotundatis areolato subintegerrimo lævibus, inde marginibus argute dentatis, dorso laminis dentiformibus nervo lamellato percurrente parallelis, nervo etiam dorso lamellis circiter tribus serratis carinato, foliis inferioribus oblongis obtusioribus, perichætialibus e basi oblonga convoluta sensim angustatis lanceolatis, theca in pedunculo elongato cylindracea curvata basin versus ventricosa.
Hab. Grande Côte, Rocky Mountains, *Drummond,* intermixed with *Oligotrichum aligerum.*

Size and habit of *A. undulatum*, Linn., but capsules more ventricose below. Intermixed with the fertile stems are others of about the same height, having the leaves all short and with a terminal bud, which appears to be young male inflorescence, but too young to be safely considered such. The parallel disposition of the tooth-like processes on the back of the leaf and the cristate nerve suffice to distinguish this species from *A. undulatum,* for which it was overlooked by Drummond.

Oligotrichum, *DeCand.*

O. aligerum, sp. nov. Caule breviusculo, foliis patulis e basi brevi paululo latiore oblonga lævi integerrima cellulis quadrato-rotundatis distinctis viridibus areolata lanceolatis obtusiusculis brevi-dentatis dorso lamellis dentatis longitudinalibus alatis, nervo percurrente lamellato dorso etiam lamellis circiter quinis dentatis carinato, perichætialibus caulinisque perichætium versus e basi obovata vaginante erecta cellulis elongatis pellucidis areolata subulatis angustioribus cæterum caulinis similibus, theca in pedunculo elongato cylindracea inferne ventricosa curvata, calyptra apice pilis paucis hirta.
Hab. Grande Côte, Rocky Mountains, *Drummond.*

In size and general appearance like *O. hercynicum,* for which species it was overlooked by Drummond himself; but its leaves are narrower, and when dry more crisped, and the presence of the lamellæ on the underside of the leaf itself, as well as upon both sides of the nerve, is remarkable and peculiar.

Pogonatum, *Brid.*

P. alpinum (*Dill.*).
Hab. Between Fort Colville and Cascade Mountains, British Columbia, *Lyall.*

Some of the specimens from N.W. America are very large, with the leaves spreading and recurved, and the capsule erect and elongate, but there appears to be no real difference excepting the external appearance.

Besides the *P. contortum*, Menzies, collected by himself in N.W. America, there are in Herb. Hooker. some specimens, not in a very good state, of what appears to be another species, more nearly allied to *P. aloides*.

P. ATROVIRENS, sp. nov. Caule simplici elongato, foliis patentibus siccitate incurvis subcrispatis e basi latiore cauli appressa late lanceolatis acutis marginibus fere a basi ad apicem serratis nervo dorso dentato pagina superiore partis folii lanceolatis lamellis fere tota obtecta, theca in pedunculo unciali oblonga erecta, operculo convexo brevirostro.

Hab. Sitka, *Barclay*.

About three inches high, blackish brown. Foliage softer than in *P. aloides*, the base with larger cells, the margins serrate almost to the very base.

P. contortum differs from this in its leaves being more nearly lanceolate throughout, not sheathing below, and the areolation at the base nearly the same as on the upper part, where they are more gradually narrowed into the point.

POLYTRICHADELPHUS, *C. Müller*.

P. LYALLII, sp. nov. Caule brevi breviter fastigiatim ramoso inferne subnudo superne, foliis e basi oblonga latiore erectiore amplexante lanceolatis patentibus sensim acutis lamellis obtectis marginibus e medio ad apicem serratis incurvis dorso convexis lævibus aut in superioribus paucidentatis, perichætialibus internis basi longioribus convolutis apicibus bevioribus, theca in pedunculo elongato flexuoso rubro suboblonga inferne ventricosa inclinata ætate horizontali supra biplicata spatio intermedio concava infra irregulari convexa basi apophyse plicata rugosa brevi sub ore contracto, operculo subuli-curvirostrato, calyptra pilis paucis brevibus appressis.

Hab. In swampy places on the east side of the Cascade Mountains, British Columbia, at an elevation of 7000 feet, July 1860, *Lyall*.

All the specimens agree in their short stems, rarely simple, with a single perichætium, but branched in a close fastigiate manner, so that at first sight the stems have the appearance of bearing a number of setæ from nearly the same point; on examination, however, each seta is found to be terminal on its own proper branch, and of these as many as nine have been observed

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on the same stem; the habit is thus the same as in *P. dendroides*, with the stems and branches abbreviated and the setæ lengthened.

POLYTRICHUM, *Dill.*

P. PILIFERUM, *Schreb.*
Hab. Vancouver Island, *Lyall.*

P. JUNIPERINUM, *Hedw.*
Hab. Saskatchewan, *Bourgeau.* Vancouver Island and near Fort Colville, British Columbia, *Lyall.* The variety *alpestre* on Cascade Mountains, British Columbia, *Lyall.*

SPHAGNUM, *Dill.*

S. ACUTIFOLIUM, *Ehrh.*
Hab. Saskatchewan and Lake Winnipeg, *Bourgeau.*

HEPATICÆ.

A small number of species belonging to this order, without any new form, are present in the collections from the Survey; and the species which in Europe are found on the ground are almost entirely unrepresented in the collections yet seen from British North America.

JUNGERMANNIA, *Linn.* (*Syn. Hepat.*).

J. BARBATA, *Schreb.*
Hab. The var. *lycopodiodes*, Nees, Galton Mountains, and on stones in the Columbia River, *Lyall.* The var. *quinquedentata*, Nees, Galton Mountains, *Lyall.* The var. *Floerkii*, Nees, Kettle Falls, Columbia River, *Lyall.*

J. VENTRICOSA, *Dicks.*
Hab. Vancouver Island and Fort Colville, *Lyall.*

J. INCISA, *Schrad.* J. supina, *Taylor.*
Hab. Fort Colville, *Lyall.*

J. MICHAUXII, *Weber.* J. oblongata *et* J. anacampta, *Taylor.*
Hab. Near Fort Colville and Columbia River, *Lyall.*

J. EXSECTA, *Schmid.* J. scitula, *Taylor.*
Hab. Fort Colville, *Lyall.*

J. CORDIFOLIA, *Hook.*
Hab. Fort Colville and Galton Mountains, *Lyall.*

J. RIPARIA, *Taylor.*
Hab. On stones in the Colville River, Fort Colville, *Lyall.*

J. SCHRADERI, *Mart.*
Hab. About Fort Colville and the Colville River, *Lyall.*

Liochlæna, *Nees.*

L. lanceolata, *Nees.*
Hab. Mooyie River, British Columbia, *Lyall.*

Solenostoma, gen. nov.

Perianthium terminale, obovatum, superne quinqueplicatum, ore in tubulum brevem contracto rostelliformi. *Folia* disticha, integra. *Amphigastria* parva obsoletave.

S. tersum, (Jungermannia) *Nees.*
Hab. Galton Mountains, *Lyall.*

Two species only of this group are yet certainly known from the whole of N. America. The other species, *S. crenulatum* (*Jungermannia,* Sm.), is indicated by Sullivant in Alabama.

This genus, long confounded with *Jungermannia,* differs from it in the form and plication of the perianth, which is similar to that of *Lejeunia* and *Frullania,* and only becomes dentate at the apex by the bursting through of the capsule.

Leioscyphus, *Mitten.*

L. Taylori, *Hook.*
Hab. Cascade Mountains, *Lyall.*

Plagiochila, *Nees et Mont.*

P. asplenioides (*Linn.*).
Hab. Fort Colville, *Lyall.*

Lophocolea, *Nees.*

L. heterophylla, *Hook.*
Hab. Fort Colville, *Lyall.*

The few fragments supposed to belong to this species are merely sufficient to indicate the presence of something very nearly allied, if not identical.

Trigonanthus, *Spruce, in Trans. Bot. Soc. Edin.* vol. iii. *et in Ann. & Mag. Nat. Hist.* s. 2. vol. v. p. 207.

(*Jungermanniæ bicuspides,* Synops. Hepat.)

T. bicuspidatus, *Linn.*
Hab. Rocky Mountains, *Lyall.*

T. divaricatus, *Smith, Eng. Bot.* t. 719. Jungermannia Starkii, *Fk. Synops. Hepat.* p. 134.
Hab. Cascade Mountains, British Columbia, *Lyall.*

These specimens have stipules, as is usual in the form referred to *J. Starkii.*

T. DENTATUS, *Raddi*.
Hab. Galton Mountains, British Columbia, *Lyall.*

CHILOSCYPHUS, *Corda*.

C. POLYANTHUS (*Linn.*).
Hab. Near Fort Colville, *Lyall.*

HARPANTHUS, *Nees*.

H. FLOTOVIANUS, *Nees*. Pleuranthe olivacea, *Taylor, in Lond. Journ. Bot.* 1846, p. 282; *Synops. Hepat.* p. 689.
Hab. Rocky Mountains, *Bourgeau.*

Chiloscyphus Drummondii, Taylor (Lond. Journ. Bot. 1846, p. 283; Synops. Hepat. p. 709), appears to be in no way different from *H. scutatus,* (*Jungermannia*) Weber et Mohr; and the habitat of this and some other North American species was incorrectly given by Taylor "in arborum cortice," for the plants are found growing on rotten wood.

SCAPANIA, *Lindenberg*.

S. ALBICANS (*Linn.*).
Hab. Rocky Mountains, *Bourgeau.* Fort Colville, *Lyall.*

S. NEMOROSA (*Linn.*).
Hab. British Columbia, *Lyall.*

S. UNDULATA (*Linn.*).
Hab. Rocky Mountains, *Lyall.*

LEPIDOZIA, *Nees*.

L. REPTANS, *Linn.*
Hab. Fort Colville, *Lyall.*

MASTIGOBRYUM, *Nees*.

M. AMBIGUUM, *Lindenberg.*
Hab. British Columbia, *Lyall.*

RADULA, *Nees*.

R. COMPLANATA, *Linn.*
Hab. British Columbia, *Lyall.*

A few fragments only.

MADOTHECA, *Dumort*.

M. NAVICULARIS, *Nees.* M. Douglasii, *Tayl. Lond. Journ. Bot.* 1846, p. 379.
Hab. Vancouver Island and near Fort Colville, British Columbia, *Lyall.*

M. LÆVIGATA, *Schrad.*
Hab. Kettle Falls, Columbia River, *Lyall.*

M. PLATYPHYLLOIDEA, *Nees.*
Hab. Fort Colville, *Lyall.*

PTILIDIUM, *Nees.*

P. CILIARE, *Ehrh.*
Hab. Fort Colville, *Lyall.*

CHÆTOPSIS, gen. nov.

Perianthium terminale, obovatum, tubulosum, ore connivente ciliato. *Folia* et *amphigastria* palmatifida.

C. TRICHOPHYLLA, *Linn.*
Hab. Cascade Mountains, *Lyall.*

FRULLANIA, *Raddi.*

F. TAMARISCI, *Linn.*
Hab. Vancouver and Orcas Islands, *Lyall.* Collected also on the N.W. coast by *Menzies and Douglas.*

The specimens are very slender, and at first sight would scarcely be supposed to belong to the same species as the European forms. The leaves are rounded, in the fertile stems acute, in the male plants with the point inflexed, and the coloured cells in some of the leaves are only found after careful search. No American examples have yet been seen which can compare with British ones in size.

METZGERIA, *Raddi.*

M. PUBESCENS, *Schrank.*
Hab. British Columbia, *Lyall.*

SARCOMITRIUM, *Corda.*

S. PALMATUM, *Hedw.*
Hab. Fort Colville, *Lyall.*

MARCHANTIA, *Linn.*

M. POLYMORPHA, *Linn.*
Hab. Saskatchewan and Rocky Mountains, *Bourgeau.* Fort Colville and Sinyakwateen, *Lyall.*

FEGATELLA, *Raddi.*

F. CONICA, *Linn.*
Hab. British Columbia, near Fort Colville, *Lyall.*

EXPLANATION OF THE PLATES.

Plate V.

Barbula rubiginosa.

1, plant, natural size.

2, leaf; 3, transverse section of same; 4, perichætial leaf; 5, capsule: all magnified.

Encalypta longipes.

1, plant, natural size.

2, leaf; 3, perichætium; 4, capsule: all magnified.

Hypnum æneum.

1, plant, natural size.

2, cauline leaf; 3, branch leaf; 4, perichætial leaf; 5, capsule; 6, portion of peristome: all magnified.

Hypnum œdipodium.

1, plant, natural size.

2, cauline leaf; 3, branch leaf; 4, perichætium and male flower; 5, capsule; 6, portion of peristome: all magnified.

Plate VI.

Hypnum declivum.

1, plant, natural size.

2, cauline leaf; 3, branch leaf; 4, perichætium and male flower; 5, capsule; 6, portion of peristome: all magnified.

Hypnum acutum.

1, plant, natural size.

2, cauline leaf; 3, perichætial leaf and male flower; 4, capsule; 5, portion of peristome: all magnified.

Hypnum asperrimum.

1, plant, natural size.

2, cauline leaves; 3, branch leaf; 4, perichætium; 5, capsule; 6, portion of peristome: all magnified.

Hypnum aggregatum.

1, plant, natural size.

2, stem leaves; 3, perichætium; 4, capsule; 5, portion of peristome: all magnified.

Plate VII.

Pterogonium procurrens.

1, plant, natural size.

2, cauline leaf; 3, branch leaf; 4, perichætium; 5, capsule: all magnified.

Stereodon plumifer.

1, plant, natural size.

2, stem leaves, with transverse section; 3, branch leaf; 4, perichætium; 5, capsule; 6, portion of peristome: all magnified.

Stereodon geminus.

1, plant, natural size.

2, stem leaf; 3, branch leaf; 4, perichætium and male flower; 5, capsule; 6, portion of peristome: all magnified.

Hedwigia pilifera.

1, plant, natural size.

2, stem leaf; 3, leaves from the branches; 4, transverse section; 5, perichætium; 6, male flower; 7, capsule: all magnified.

PLATE VIII.

Dichelyma uncinatum.

1, plant, natural size.

2, leaf; 3, perichætium and capsule 4, portion of peristome: all magnified.

Atrichum parallelum.

1, plant, natural size.

2, leaf from the lower part; 3, the same from upper part of the stem; 4, transverse section of the middle of the latter; 5, perichætial leaf: all magnified.

Oligotrichum aligerum.

1, plant, natural size.

2, a leaf from the middle of the stem; 3, perichætial leaf; 4, perigonial leaf; 5, calyptra: all magnified.

Polytrichadelphus Lyallii.

1, plant, natural size.

2, leaf from the middle of the stem, with section; 3, perichætial leaf; 4, capsule; 5, section of same; 6, calyptra: all magnified.

Flora of the Jhelum District of the Punjab. By J. E. TIERNEY AITCHISON, M.D., F.L.S.

[Read December 17, 1863.]

THE following paper, which I have the honour to lay before the Society, is the result of observations made in the Jhelum District during the years 1859, 1860, and 1861, whilst acting as Civil Assistant-Surgeon in that district. The opportunities for botanical research throughout the district were not very numerous, from my medical duties requiring my presence at the headquarters of the district, viz. at the town of Jhelum; and when they did occur, it was generally not at a good season for the botanist. However, with the exception perhaps of that part of the Salt Range included in the district, the flora may be considered as tolerably complete.

From the position of the district of Jhelum—close to the base of the hills that surround Cashmere on the one hand, and on the other gradually extending in a south-westerly direction towards the Sind-Sagur and Jetch Dooabs, towards Edgeworth's Country—it forms a link of union between the Mooltan and Cashmere floras, the altitude of Mount Tilla and of the Salt Range giving us some of the botany to be met with on the lower range of the Himalaya.

The Jhelum District is bounded on the south by the river Jhelum, on the south-east by the Kharian hills, on the east and north-east by the bend of the Jhelum river (which is here the boundary between the British and Cashmere territories), on the north by the ravine-country of the Rawul Pindee district, and on

the west by no natural division, but a line drawn from Shapore to Tullagung would be tolerably correct.

The eastern half of the district has the Bukrala and Ratian ranges of hills running through it, with, as already alluded to, the Kharian range, forming the south-eastern boundary. The average height of these three ranges of hills may be said to be 1100 feet above the sea-level.

Between the Ratian and Kharian ranges runs the river Jhelum: the Kharian range above the town of Jelallpore bends across to the river and ends on its bank, but is seemingly carried on in its course on the north of the river by the Surafer hills.

The Bukrala, Ratian, and Kharian hills (the last by means of the Surafer) unite to form the Salt Range, which at once rises to the height of 2000 feet, some parts averaging 2500 feet, and a few points come up to nearly 3000 feet above the sea-level.

One of the most westerly parts of the Ratian Range, Mount Tilla, rises to 3200 feet. This occurs, however, before this range joins to form the Salt Range.

The Salt Range formed from these three ranges of hills takes a westerly course towards the Indus river, cutting the western half of the Jhelum district into two parts—the portion between the hills and river, and the portion to the north of these hills.

The portion of the district lying on both sides of the river as it passes between the Ratian and Kharian hills consists of well-cultivated plains, through which pass the Boonah and Bukrala nullas. The botany of this part is decidedly that of the cultivated parts of the North-west Provinces. In the Kharian, Ratian, and Bukrala ranges of hills, of which I shall always hereafter speak as the low ranges of hills, there is no cultivation, but they are covered by a low jungle of *Acacia modesta* (stunted), *Capparis aphylla, Carissa diffusa, Grewia betulifolia, Sageretia Brandrethiana, Gymnosporia spinosa, Ehretia aspera*, &c., upon which large droves of cattle, sheep, goats, camels, &c., are sent to graze.

Between the Ratian and Bukrala ranges and the whole of the district to the north of the Salt Range and Bukrala hills, the land is extensively cut up by ravines and water-courses. The soil is very poor, and more or less saline, as shown by the presence of *Anabasis multiflora, Caroxylon fœtidum*, and *Tamarix*. There are here no trees but what are cultivated, and these, few in number, chiefly consist of *Acacia Arabica* and *Zizyphus Jujuba*. As we pass westwards, however, near Tullagung, trees are more plentiful—some even indigenous, as the Sissoo—and the soil richer, producing fine crops, chiefly of the pulses; indeed the grain of this

part of the district supplies much of the Punjab. The crops about this ravine-country are very much more dependent upon rain than those of any other part of the district, from the soil being apparently quite incapable of retaining moisture. The characteristic botany of the ravines themselves is chiefly composed of *Nerium odorum*, *Saccharum spontaneum*, and *Butea frondosa*. In the uncultivated parts a very similar jungle to that found on the lower ranges of hills exists.

To the south of the Salt Range we have plains extending to the river, which, the further we get westwards from Jelallpore, become more saline in their nature, and, except close to the river's bank, with some other exceptional localities, gradually become devoid of cultivation, producing a jungle of *Tamarix*, *Salvadora*, *Prosopis*, *Capparis*, *Suæda*, *Anabasis*, &c. Where the soil is becoming highly charged with saline matter, amongst the most characteristic signs is the change of *Æluropus repens* for *Cynodon Dactylon* and the profusion of *Cressa Cretica*.

From Jelallpore towards Pind-dadan Khan the exception is to have soil incapable of cultivation, and what is cultivated is rich, producing fine crops, including sugar-cane as a field crop; this is not producible in any other part of the district. Besides, the soil, from its less elevation above the river, is very much moister, and, as a proof of this, rice is raised in some spots. Trees are plentiful and produce good timber; the Cypress variety of the *Acacia Arabica* is very characteristic.

Passing from Pind-dadan Khan westwards we very quickly come upon a country the greater part of the soil of which is incapable of cultivation, and is covered by a jungle of shrubs,—the portion that is cultivable being a narrow strip on the river's bank, which yields fair crops, with some timber, chiefly of *Acacia Arabica* and *Zizyphus Jujuba*, as also groves of Date-palms. This arable part is called the Kachi, and the part that is unfit for cultivation and covered with jungle, the Bar. In short, we have here a similar state of things to that met with in the Dooabs.

The Salt Range, from its elevation, has a very interesting flora. Besides the ridges of hills and valleys of which it is chiefly formed, it has, running through it, extensive plains of tableland which produce fine crops of wheat, greatly dependent, however, upon rain. On the occurrence of a dry season a complete destruction of the crops takes place. The ridges themselves are covered with a thickly wooded jungle of the Olive, *Dodonæa*, *Buxus*, as well as of the vegetation which occurs on the low ranges of hills.

Amongst the hills here and there we have springs of fresh water running through the valleys, which, as long as they run upon a stratum above the salt, give rise to a great luxuriance of vegetation. In these valleys we meet with much fertile soil, and have, for the first time, the cultivation of the Poppy to some extent. *Rhus integerrima*, producing good timber, with *Bombax heptaphyllum*, and in some localities the Mulberry and *Acacia modesta*, grow in great luxuriance; the Vine also is to be met with naturalized. In the fields of the tableland *Salvia Moorcroftiana* is found everywhere, besides *Edwardsia Hydaspica*, *Gypsophila Vaccaria*, *Lithospermum arvense*, *Lepidium*, &c.

Mount Tilla, the most westerly of the Ratian Range, has a more wooded appearance than any part of the Salt Range; for the latter is chiefly wooded in its valleys, whereas Mount Tilla, from apparently its greater moisture, is wooded all over, chiefly, however, where the altitude rises above 2000 feet, with trees of *Bombax*, *Rhus*, *Moringa*, *Olea*, *Acacia rubicaulis*, *Rottlera*, *Kydia*, *Cordia*, *Celtis*, &c. Besides these we have the following, dependent upon the altitude obtained, viz. *Galium*, *Geranium*, *Convolvulus*, *Cheilanthes*, and *Asplenium*. In addition to these we have *Punica Granatum*, naturalized, if not indigenous, and a solitary specimen of *Pinus longifolia*, introduced about thirty years ago. *Phœnix sylvestris* covers the hill on its western aspect from its base to its summit.

In conclusion, I beg to return my most sincere thanks to Dr. Thomas Thomson for the care and trouble he took in my behalf in naming and correcting my collection of plants, and to Dr. Joseph Dalton Hooker for the kind and very liberal manner in which he permitted me to make use of the Kew Herbarium and Library.

Flora of the Jhelum District of the Punjab.

THALAMIFLORÆ.

Ranunculaceæ.

Clematis Gouriana, *Roxb.* Mount Tilla only.
Delphinium saniculæfolium, *Boiss.* On Mount Tilla, rare.
Ranunculus aquatilis, *L.* Not common.
—— muricatus, *L.* Not common.
—— sceleratus, *L.* Very common.

Menispermaceæ.

Cissampelos Pareira, *L.* Mount Tilla.
Cocculus Lemba, *Forsk.*

Nymphæaceæ.

Nymphæa alba, *L.*?
—— stellata, *Willd.*
—— Lotus, *L.*

Nelumbiaceæ.

Nelumbium speciosum, *Willd.* Common in ponds that have some depth of water.

Fumariaceæ.

Fumaria parviflora, *Lam.*

Papaveraceæ.

Papaver somniferum, *L.* Cultivated on the plains upon the Salt Range.

Cruciferæ.

Brassica campestris, *L.* Cultivated largely as a field produce for the seed, from which, by simple expression, is obtained Surson oil.

—— Eruca, *L.* Cultivated largely for its seed, from which, by simple expression, is obtained black Surson oil—the oil obtained from this being much darker in colour than that of *B. campestris.* Another name for the dark oil is "Tarameera" oil.

The harvest for collecting the seed of the above two plants is about the end of June or beginning of July; but where irrigation is much resorted to, the crop is often collected as early as May and as late as October. With irrigation their cultivation may be carried on throughout the whole hot season.

Capsella Bursa-pastoris, *R. Br.*
Farsetia Jacquemontii, *H. f. & T.* Common in the Salt Plains.
Goldbachia lævigata, *DC.*
Lepidium sativum, *L.* Naturalized all over the district.
Malcolmia Africana, *R. Br.*
—— strigosa, *Boiss.* Plains upon Salt Range, frequent.
Nasturtium officinale, *L.*
Physorhynchus Brahuicus, *Stocks.* On the low ranges of hills rare, but common and characteristic over Mount Tilla and the Salt Range above 1500 feet from the sea-level.
Sisymbrium Irio, *L.*
—— Sophia, *L.*

Resedaceæ.

Oligomeris glaucescens, *Camb.*

Capparidaceæ.

Capparis aphylla, *Roxb.* A characteristic shrub over the whole district, called "Kureel:" an excellent firewood—burns readily even when green. The wood does well instead of box-wood for turning-purposes. The fruit is preserved by the natives as a sort of pickle, and called "Teuti."

—— spinosa, *L.* Common in the Salt Range.

Cleome icosandra, *DC.*
—— linearis, *Stocks.*
—— pentaphylla, *L.* Called "Hool-hool-sufaid."
—— ruta, *Jacq.*
Cratæva Roxburghii, *Br.* Called "Burna." The clammy mucilage of the fruit, as well as its rind, are used to make a cement: from the astringency of the latter it is used as a mordant in dyeing. The timber, although large, is of no value.

Violaceæ.

Viola cinerea, *Boiss.*
—— tricolor, *L.* Naturalized from cultivation.

Polygalaceæ.

Polygala arvensis, *Willd.*
—— Vahliana, *DC.*

Caryophyllaceæ.

Arenaria serpyllifolia, *L.*
—— ——, var. rotundifolia. Above the Fort of Mungla, on rocks covered with damp mould, on the banks of the river.
Gypsophila Vaccaria, *L.* Plains upon the Salt Range.
Mollugo cerviana, *Ser.*
—— nudicaulis, *L.*
Silene conica, *L.*
—— rubella, *L.* Escaped from cultivation.
Spergularia rubra, *Pers.*

Portulacaceæ.

Portulaca oleracea, *L.* Called "Monkha."
—— quadrifida, *L.*

Linaceæ.

Linum usitatissimum, *L.* Cultivated for its seed only, which is collected in April, and from which is extracted, by simple expression, the oil. Called by the natives "Ulseeka thail."

Malvaceæ.

Abutilon Indicum, *G. Don.*
Gossypium herbaceum, *L.* Cultivated throughout the district, but not more than is required for local consumption. To produce a fibre of good quality, irrigation in this district is essential.
Hibiscus Gibsoni, *Stocks.* On Mount Tilla, above 2000 feet.
—— vitifolius, *L.* On Mount Tilla only; also cultivated in gardens.
Lagunea lobata, *Willd.*
Malva parviflora, *L.*
Sida cordifolia, *L.*
—— humilis, *L.*
—— rhombifolia, *L.*

Sterculiaceæ.

Bombax heptaphyllum, *L.* Mount Tilla and Salt Range, common. Called "Sembul."

Sterculia. Species not recognized, from absence of flower and fruit. This is a most characteristic shrub on Mount Tilla, at an altitude of above 2500 feet, from its conspicuous foliage.

Byttneriaceæ.

Kydia calycina, *Roxb.* Mount Tilla, above 2000 feet.

Melhania abutiloides, *Arn.* Profuse on Mount Tilla.

Tiliaceæ.

Corchorus acutangulus, *L.*

—— olitorius, *L.* Not cultivated in this district.

—— tridens, *L.*

Grewia betulifolia, *Juss.* A characteristic shrub throughout the low ranges of hills.

—— oppositifolia, *Ham.* Mount Tilla, common at 2500 feet.

—— Rothii, *DC.* Mount Tilla, common.

—— villosa, *Roth.* Mount Tilla, not common.

Triumfetta angulata, *Lam.*

Meliaceæ.

Melia Azedarach, *L.* Cultivated. Called "Persian Lilac," "Buchyan," and "Dek."

Cedrelaceæ.

Cedrela Toona, *Roxb.* Cultivated. Called "Toon."

Sapindaceæ.

Cardiospermum Halicacabum, *L.*

Dodonæa Burmanniana, *DC.* Profuse on the western aspect of Mount Tilla and on the Salt Range. Called "Syna."

Vitaceæ.

Vitis carnosa, *Wall.*

—— vinifera, *L.* Cultivated, and upon plains above Salt Range apparently naturalized.

Geraniaceæ.

Geranium lucidum, *L.* Summit of Mount Tilla only.

—— rotundifolium, *L.* Summit of Mount Tilla only.

Oxalidaceæ.

Oxalis corniculata, *L.*

Zygophyllaceæ.

Fagonia Cretica, *L.*

Peganum Harmala, *L.* Called "Hoormul."
Tribulus terrestris, *L.*

Aurantiaceæ.

Feronia Elephantum, *L.* Cultivated.

CALYCIFLORÆ.

Rhamnaceæ.

Rhamnus Persica, *Boiss.* Mount Tilla, rare.

Sageretia Brandrethiana, n. sp. Foliis ellipticis, utrinque obtusis, tenuissime dentatis, subtus cinereo tomentosis.

A small shrub, with rigid, somewhat pubescent, generally opposite branches, often converted into spines. Leaves less than an inch long, and often much smaller, glabrous and dark green above, with a dense, woolly, whitish covering on their under surface. Flowers fascicled along the lateral branches as in the other species.

The densely whitish-woolly under surface of the leaves is diagnostic of this species from all the others of the genus.

A characteristic shrub of the low ranges of hills, called by the natives "Kohare." It is No. 105 of Fleming's Collection from the Salt Range, in the Kew Herbarium, which has the same native name.

Zizyphus Jujuba, *L.* "Baer." The leaves and fruit make good fodder for cattle, for which purpose it is cultivated. The branches make excellent hedges. The wood supplies the zemindar with his ploughs, well-wheels, and timber for his house. The tree yields a lac, called "Baree-kalak," used in dyeing.

—— Jujuba, var. hortensis, is rare in this district.

—— nummularia, *W. & A.* Common, and assists in forming much of the "Baer" jungles, which are preserved for fodder for cattle.

—— vulgaris, *Lam.* Not common. "Choya."

Celastraceæ.

Gymnosporia spinosa, *Hook. fil.* Called by the natives "Putaker." Very characteristic of the low ranges of hills.

Moringaceæ.

Moringa pterygosperma, *Gaert.* Called "Sohounja" by the natives: the fruit used by them in their curries. The roots used by Europeans as a substitute for horse-radish, hence called "Horse-radish tree." Mount Tilla, common; also Salt Range. No oil extracted from the seed.

Anacardiaceæ.

Mangifera Indica, *L.* Cultivated. "Mango."

Rhus integerrima, *Wall.* Called by the natives "Kuker-singha," from the horn-like appendages borne on its branches, caused by insects. Yields tolerably good timber, which is used for cabinet-work. Called "Zebra-wood" from the appearance presented by the wood. Mount Tilla and Salt Range, above 2000 feet.

LEGUMINOSÆ.

Acacia Arabica, *L.* Common over the district, but not above the altitude of 1000 feet. Yields valuable timber, more especially for woodwork that is to be exposed to extremes of temperature with moisture, as that connected with wells. The branches make excellent fences; the soft leaves, flowers, and fruit yield fodder for cattle; the bark is used for tanning, and making country spirits; the small wood for charcoal; and the gum is valuable. It is called "Keekur" by the natives, and of it we have two varieties:—

Var. cupressina, which, from its peculiar form, can be distinguished miles off; and

Var. spina albida, in which the tree is covered with large white spines.

—— eburnea, *Willd.* Salt Range, not common.

—— Farnesiana, *Willd.* Cultivated. Flowers chiefly during the cold weather, with a strong, sweet perfume.

—— modesta, *Wall.* "Phulai." The timber is of great value, from its durability and hardness, for cog-wheels, &c. Grows as a characteristic shrub over the low ranges of hills, supplying a large portion of the firewood used in the district.

Albizzia Lebbek, *Benth.* Cultivated tree called "Sirrus."

Alhagi Maurorum, *DC.*

Alysicarpus nummularifolius, *DC.*

Argyrolobium roseum, *Jaub. & Sp.*

—— uniflorum, *Jaub. & Sp.* Mount Tilla, common.

Astragalus leucocephalus, *Benth.* On the Salt Range at 2000 feet above the sea-level, common.

—— multiceps, *Wall.* Characteristic of the low ranges of hills.

—— tribuloides, *Del.*

—— (species).

Bauhinia variegata, *L.* Cultivated. Called "Kochnar."

Butea frondosa, *Roxb.* Called "Dhak," and also "Plass." Is characteristic of the Ravine-country: much ground on which this grew is being reclaimed. The wood is used for firewood; the bark of the root is made into rope; the exuded resin (Indian Kino) is used medicinally by the natives, as well as for tanning and as a mordant in dyeing; the flowers as a dye; the leaves for wrapping up the various commodities sold in a bazaar, as fodder for elephants, and bedding for cattle.

Cassia acutifolia, *Del.* "Senna." Cultivated.

—— Fistula, *L.* Cultivated. "Amultas," Indian Laburnum.

—— mimosoides, *L.* Mount Tilla.

—— Tora, *L.* "Punwar."

Cicer arietinum, *L.* Cultivated. Yields the pulse called "Chunnah."

Crotalaria Burhia, *Ham.* Is characteristic of the Salt Plains. Rare in the low ranges of hills.

—— juncea, *L.* Cultivated in strips round fields. Called "Sunni," and yields a fibre called "Sunn."

—— medicaginea, *Lam.*

—— sericea, *Retz.* Cultivated.

Cyamopsis psoralioides, *DC.*

Dalbergia Sissoo, *Roxb.* Largely cultivated, yielding good timber. Found wild in ravines near Mount Tilla and Tullagung. Called "Sheshum."

Dolichos uniflorus, *Lam.*

Edwardsia Hydaspica, *Edgw.* In great quantity at Choya and Kutas. Called "Koon." No animals will feed on it; if cows do, they are poisoned by it.

Ervum Lens, *L.* Cultivated: yields the pulse called "Musoor."

Guilandina Bonducella, *L.* It is doubtful if this has not been introduced at Pind-dadan Khan, Kulla-kahar, &c. Called "Kut-karounga." Used as a febrifuge by the natives.

Indigofera cordifolia, *Heyne.*

—— linifolia, *Retz.*

—— Senegalensis, *DC.*

—— tinctoria, *L.* Cultivated chiefly in small quantities to dye the beards of the cultivators blue. Called "Neel."

Lathyrus annuus, *L.*

—— Aphaca, *L.*

Lespedeza cuneata, *Don.* On Mount Tilla only.

Medicago denticulata, *Willd.*

Melilotus parviflora, *Lesf.*

Mimosa rubicaulis, *Lam.* On Mount Tilla this takes the place of *Acacia Arabica*, as the latter begins to disappear upon reaching an altitude of above 1000 feet.

Mucuna (species not determinable). On Mount Tilla only, near the summit.

Nomismia aurea, *W. & A.*

Parkinsonia aculeata, *L.* Cultivated: is becoming naturalized.

Phaseolus aconitifolius, *L.* Cultivated. Yields the pulse called "Moth."

—— Mungo, *L.* Yields the pulse called "Mung."

—— trilobus, *Ait.* In great profusion on the eastern face of Mount Tilla.

Poinciana pulcherrima, *L.*

Prosopis spicigera, *L.* A characteristic tree throughout the Salt Range, as also amongst the jungle between these hills and the river Jhelum.

Not one specimen of this to be met with to the east of Jelallpore. Called "Jand" by the natives, who eat the green fruit largely.

Psoralea corylifolia, *L.* Rare. Called "Choya."

Rhynchosia minima, *DC.*

Sesbania aculeata, *Pers.*

—— Ægyptiaca, *Pers.* Cultivated: is becoming naturalized.

Tamarindus Indica, *L.* Cultivated. Called "Imlee."

Taverniera nummularia, *DC.* Characteristic shrub of low ranges of hills.

Tephrosia purpurea, *Pers.* A noxious weed.

—— tenuis, *Wall.* Mount Tilla only.

Trigonella incisa, *Royle.*

Vigna carinalis, *Benth.* Mount Tilla, near the summit.

Vicia sativa, *L.*

Rosaceæ.

Potentilla supina, *L.*

Rubus niveus, *Wall.* Found amongst stones at the water's edge, above the Fort of Mungla, in April,—its presence due to the seeds being carried down from their natural station to this locality by the river.

Drupaceæ.

Amygdalus communis, *L.* Cultivated.

Pomaceæ.

Cydonia vulgaris, *L.* Cultivated. Called "Bailee."

Pyrus Malus, *L.* Cultivated. Called "Sayoo."

Lythraceæ.

Grislea tomentosa, *Roxb.*

Lawsonia alba, *Lam.*

Myrtaceæ.

Punica Granatum, *L.* Cultivated in gardens. On the summit of Mount Tilla, apparently wild.

Syzygium Jambolanum, *DC.* Cultivated tree, called "Goulab Jaman."

Tamaricaceæ.

Tamarix dioica, *Roxb.* On islands in the river. Called "Pilchee," "Jhao," and "Furas." The term "Pilchee" is as frequently applied to reeds, "Furas" to the *T. Indica.* "Jhao" seems to be the most correct name. It yields a variety of galls called "Burree muee," a large export from the Mooltan district.

—— Indica=gallica, *L.* Occurs from a small bush to a large tree upon the most unfavourable soil for vegetable growth, and forms the greater part of the jungle in the Salt Plains. This, as well as *T. orientalis,* is called "Furas." The latter I am not aware of having met with, although this may be from not having seen it in flower to recognize it.

Tetragoniaceæ.

Trianthema pentandra, *L.*

Illecebraceæ.

Polycarpæa corymbosa, *Lam.*

Cucurbitaceæ.

Cucumis Colocynthis, *L.* Used by the natives as a purgative for horses: called "Indrawn."
—— utilissimus, *Roxb.*
Luffa amara, *Roxb.* Mount Tilla and Salt Range, very common.
Momordica dioica, *Roxb.*

Samydaceæ.

Casearia tomentosa, *Roxb.* Not common.

Umbelliferæ.

Apium graveolens, *L.* Kulla-kahar, Salt Range.
Coriandrum sativum, *L.*
Hydrocotyle Asiatica, *L.*
Pimpinella crinita, *Boiss.* Very common.
Ptychotis Coptica, *DC.* Field weed.
Torilis nodosa, *L.*

Cinchonaceæ.

Borreria lasiocarpa, *W. & A.*
Gardenia tetrasperma, *Roxb.* Mount Tilla and Kutas.
Hamiltonia suaveolens, *Roxb.* Mount Tilla. Called "Mud-maltee."
Hedyotis aspera, *Heyne.* Mount Tilla: profuse.

Galiaceæ.

Galium Aparine, *L.* Summit of Mount Tilla.

Compositæ.

Aplotaxis candicans, *DC.*
Artemisia scoparia, *W. & K.*
Berthelotia lanceolata, *DC.* In great luxuriance near Chuckowal.
Bidens bipinnata, *L.* Mount Tilla.
Blainvillea latifolia, *DC.*
Blumea lacera, *DC.*
Carthamus tinctorius, *L.*
Centaurea Calcitrapa, *L.*
—— Cyanus, *L.*
Cichorium Intybus, *L.* Cultivated: called "Kasnee."
Conyza absinthifolia, *DC.*
Echinops echinatus, *Roxb.*
Eclipta erecta, *L.*
Erigeron Canadensis, *L.*

Filago Germanica, *L.*
Francœuria crispa, *Cass.* Rare.
Gnaphalium luteo-album, *L.* Near water, Choya.
Inula vestita, *DC.* On the summit of Mount Tilla.
Lactuca auriculata, *DC.*
Machlys hemisphærica, *DC.*
Microrhynchus nudicaulis, *Less.*
Picridium Tingitanum, *Desf.* On a rocky ridge between Mount Tilla and the village of Bagree.
Pluchea. Of this, two apparently new species were picked up, growing in great luxuriance (quite arborescent) upon the red clay marl, at the gorges of the Salt Range.
Sclerocarpus Africanus, *Jacq.* Mount Tilla, near the summit.
Sonchus arvensis, *L.*
—— asper, *L.*
Trichogyne cauliflora, *DC.*
Vernonia cinerea, *Less.*
Xanthium Strumarium, *L.*

Campanulaceæ.

Campanula canescens, *Wall.* Summit of Mount Tilla.

COROLLIFLORÆ.

Primulaceæ.

Anagallis arvensis, *L.*
Androsace rotundifolia, *Ham.*
Samolus Valerandi, *L.* Plains upon Salt Range.

Oleaceæ.

Olea Europæa, *L.* (ferruginea, *Wall.*). Met with wherever the elevation is above 1500 feet from sea-level as a shrub, but at 3000 feet it is a well-formed tree: called "Cow" by the natives. The wood is chiefly used for handles of axes (koolharees), for turning-purposes, and as firewood. It constitutes a little of the jungle on the highest part of the low ranges of hills, forming the main part of that on the Salt Range.

Jasminaceæ.

Jasminum grandiflorum, *L.*
Nyctanthes arbor-tristis, *L.* Cultivated. Called "Harsingar."

Apocynaceæ.

Carissa diffusa, *Roxb.*
Nerium odorum, *Sol.* Called "Kuniyoor daflee."
Rhazya stricta, *Dne.* In soil much impregnated with saline matter,

chiefly where the gorges of the Salt Range open out into the plains; also forming part of the jungle in the Salt Plains.

Thevetia neriifolia, *Juss.* Cultivated.

Asclepiadaceæ.

Boucerosia Aucheri, *Dne.* Over all the hills of the district, chiefly low ranges: called "Choonga." The natives eat it largely in an uncooked state.

Calotropis procera, *R. Br.* Called "Ak" and "Madar."

Dæmia extensa, *R. Br.* Mount Tilla.

Pentatropis spiralis, *Edgw.*

Periploca aphylla, *Dne.* Forms a large part of the jungle on the low ranges of hills. Very greedily eaten by goats, &c.

Gentianaceæ.

Erythræa ramosissima, *Pers.* Near Fort Mungla.

Convolvulaceæ.

Batatas pentaphylla, *Choisy.*

Convolvulus arvensis, *L.*

—— pluricaulis, *Choisy.*

——, n. sp. Very near *C. saxatilis,* if it is not identical with it. On limestone formation, between Kula-kahar and Surdee.

Cressa Cretica, *L.* A very characteristic plant over the Salt Plains, commencing to the west of Jelallpore.

Evolvulus alsinoides, *L.*

Ipomæa muricata, *Roxb.*

—— pilosa, *Choisy.* Summit of Mount Tilla.

—— sessiliflora, *Roth.*

Pharbitis Nil, *Choisy.* Summit of Mount Tilla. Yields the seed "Kaladana" used as a purgative by the natives.

Rivea ornata, *Choisy.*

Cuscutaceæ.

Cuscuta reflexa, *Roxb.* Called "Akas-bel."

Cordiaceæ.

Cordia latifolia, *Roxb.* Lessoora, cultivated.

—— Myxa, *L.* Cultivated.

—— vestita, *H. f. & T.* One tree only of this in the district, on Mount Tilla; this apparently introduced.

Boraginaceæ.

Anchusa hispida, *Forsk.*

Arnebia hispidissima, *DC.*

Bothriospermum tenellum, *F. & M.* Where the Chumuck joins the Jhelum River.

Cynoglossum micranthum, *Desf.*
Lithospermum arvense, *L.* Corn-fields upon Salt Range, common.
Nonnea pulla, *DC.*
Trichodesma Indicum, *R. Br.*

EHRETIACEÆ.

Ehretia aspera, *Roxb.* Called "Chumror" and "Kookhun."
Heliotropium Europæum, *L.*
—— strigosum, *Willd.*
—— strigosum, var. linifolium.
—— undulatum, *Vahl.*

SOLANACEÆ.

Datura fastuosa, *L.* Called "Datoora."
—— Stramonium, *L.* Naturalized.
Lycopersicum esculentum, *L.* Cultivated.
Physalis minima, *L.* Asgund.
Solanum gracilipes, *Jacq.*
—— Jacquini, *Willd.* Called "Kuthelee-kunth."
—— nigrum, *L.*
—— sanctum, *L.* Common.
Withania coagulans, *Dun.* Rare.
—— somnifera, *Dun.*

BIGNONIACEÆ.

Amphicome Emodi, *Royle.* Mount Tilla and Fort Mungla.
Tecoma undulata, *G. Don.* Low ranges of hills and ravines: common. Called "Loora."

SCROPHULARIACEÆ.

Antirrhinum Orontium, *L.*
Buddleia Neemda, *Roxb.* Fort Mungla.
Celsia Coromandeliana, *Vahl.*
Herpestes Monnieri, *H. B. K.*
Linaria ramosissima, *Wall.* Characteristic of the low ranges of hills and ravines.
—— triornithophora, *Willd.* Cultivated.
Lindenbergia macrostachya, *Benth.* Near river Jhelum, Fort Mungla.
—— polyantha, *Royle.*
—— urticæfolia, *Lehm.* Mount Tilla.
Mazus rugosus, *Lour.*
Mimulus gracilis, *R. Br.* Not common: near river and tanks.
Scrophularia scabiosæfolia, *Benth.* Ravines near Chuckoa.
Striga euphrasioides, *Benth.* Rare. Mount Tilla.
Veronica agrestis, *L.*
—— Anagallis, *L.*
Verbascum Thapsus, *L.*

ACANTHACEÆ.

Justicia Adhatoda, *L.* Characteristic over the whole district. Called "Bansa" and "Bakoor" by the natives. No animal will eat it.
Barleria cristata, *L.* Mount Tilla and Salt Range, common.
Dicliptera Roxburghiana, *Nees.*
Dipteracanthus prostratus, *Nees.*
Rostellaria peploides, *Nees.*

PEDALIACEÆ.

Sesamum Indicum, *L.* Cultivated in fields for its seeds, called "Tillee." The oil obtained from its seeds called "Til-ka-thail."

LABIATÆ.

Anisomeles ovata, *R. Br.* Not common. Duriala.
Ballota limbata, *Benth.* Characteristic of the low ranges of hills.
Colebrookia oppositifolia, *Sm.* Mount Tilla and Salt Range, not below 2000 feet.
Eremostachys Vicaryi, *Benth.* At Choya only.
Lallemantia Royleana, *Benth.* Abundant near the Fort of Rhotas; rare over the rest of the district. Quite wild.
Lamium amplexicaule, *L.*
Leucas cephalotes, *Spr.*
—— nutans, *Spr.*
—— urticæfolia, *Benth.*
Micromeria biflora, *Benth.* Abundant near Fort Mungla.
Nepeta ruderalis, *Ham.* Mount Tilla, common.
Ocimum Basilicum, *L.*, var. thyrsiflorum. Cultivated.
—— sanctum, *L.* Low ranges of hills, common.
Plectranthus rugosus, *Benth.* In great luxuriance on Mount Tilla.
Salvia Moorcroftiana, *Wall.* The plains upon Salt Range, in great abundance throughout the fields. Called "Kalather."
—— plebeia, *R. Br.* Summit of Mount Tilla.
—— pumila, *Benth.* Very characteristic of low ranges of hills and ravines. Sheep very fond of it.
Stachys parviflora, *Benth.* Plains upon the Salt Range.

VERBENACEÆ.

Clerodendron phlomoides, *L.*
Duranta Plumieri, *L.* Cultivated.
Lantana alba, *Mill.* Common upon all the hills.
Lippia nodiflora, *Rich.*
Verbena officinalis, *L.*
Vitex Negundo, *L.* Mount Tilla only, on its summit.

PLANTAGINACEÆ.

Plantago amplexicaulis, *Cav.*

Plantago ciliata, *Desf.*
—— decumbens, *Forsk.*

Plumbaginaceæ.

Plumbago Zeylanica, *L.* On Mount Tilla. Not common on Salt Range.

Salvadoraceæ.

Salvadora oleoides, *Dne.* Is only to be met with on the western aspect of the Surafer and the southern of the Salt Range hills, and the plains extending from the bases of these hills towards the river. It forms a very large part of the "Bar" jungle, and is called "Pelu." The fruit is eaten by the natives.

MONOCHLAMYDEÆ.

Polygonaceæ.

Polygonum aviculare, *L.*
—— barbatum, *L.*
—— Persicaria, *L.*
Rumex acutus, *Roxb.*
—— vesicarius, *L.* In the gorges leading from the Salt Range, in the beds of salt-water streams: common.

Nyctaginaceæ.

Boerhaavia diffusa, *L.*
—— repanda, *Willd.* Mount Tilla only.

Chenopodiaceæ.

Anabasis multiflora, *Moq.* Salt Plains.
Atriplex laciniata, *L.* Near Doomun.
Caroxylon fœtidum, *Moq.* This plant, with *Suæda fruticosa, L.,* and *Anabasis multiflora,* occupies large tracts of land that are incapable of producing useful vegetation, from Jelallpore, where we occasionally meet with them, passing westwards to the Salt Plains, where, with the larger jungle, they seem to be the only vegetable products. From this plant, by burning, is obtained "Sudgee," a coarse carbonate of potash and soda.
Chenopodium album, *L.*
—— murale, *L.*
Suæda fruticosa, *L.* Salt Plains.

Phytolaccaceæ.

Giesekia linearifolia, *Moq.*
Limeum Indicum, *Stocks.*

Amarantaceæ.

Achyranthes aspera, *L.*
Ærua Javanica, *Juss.*

Ærua scandens, *Juss.*
Alternanthera sessilis, *R. Br.*
Celosia argentea, *L.*
Digera arvensis, *Forsk.*
Euxolus viridis, *Moq.*, var. caudatus.
Mengea tenuifolia, *Moq.*
Pupalia lappacea, *DC.*

LAURACEÆ.

Tetranthera Roxburghii, *Nees.* Mount Tilla: not common; not cultivated.

EUPHORBIACEÆ.

Andrachne telephioides, *L.* River side, above Mungla: common.
Baliospermum Indicum, *Dne.*
Buxus sempervirens, *L.* Salt Range: common. Called "Pupper." The branches with the leaves on used to thatch houses, as the leaves do not decay easily: wood only used as firewood.
Crozophora tinctoria, *Juss.*
Euphorbia Chamæsyce, *L.*
—— dracunculoides, *Lam.*
—— Helioscopia, *L.*
—— hypericifolia, *L.*
—— Nepalensis, *Boiss.*
—— thymifolia, *L.*
Phyllanthus Emblica, *L.* Called "Horola." Cultivated.
—— Niruri, *L.* Mount Tilla only.
Ricinus communis, *L.* The oil is not extracted from the seed in this district, but the seeds are eaten in curries by the natives. Called "Arund" and "Bed-ungeer."
Rottlera tinctoria, *Roxb.* Mount Tilla: common. Called "Rovin," "Roolee," and "Kameela." The red epidermis of the fruit is recognized as a vermifuge for the tape-worm by the natives, and also used as a dye.

ULMACEÆ.

Celtis Caucasica, *Willd.* Mount Tilla, common, showing good timber at above 2500 feet.

SALICACEÆ.

Populus Euphratica, *Oliv.* Cultivated: rare: good trees at Goozerat.
—— dilatata, *Ait.* Cultivated, Sofaida.
Salix Babylonica, *L.* Cultivated. Called "Mujnoo."

CANNABINACEÆ.

Cannabis sativa, *L.*

URTICACEÆ.

Forskolea tenacissima, *L.* Mount Tilla and Salt Range.

Moraceæ.

Ficus caricoides, *Roxb.* Called "Goojratee Anjeer."
—— Indica, *L.* Called "Bore, Burgot."
—— infectoria, *Willd.*
—— religiosa, *L.* Called "Pipul."
Morus alba, *L.* On the plains upon the Salt Range, near water. This is a fine tree; but in all other parts of the district, unless in gardens, it is but a stunted withered shrub. Called "Toot."
—— lævigata, *Wall.* Cultivated for its fruit in gardens.

Pinaceæ.

Pinus longifolia, *Lamb.* On Mount Tilla one fine specimen, introduced. Called "Cheer."

ENDOGENS.

Araceæ.

Typhonium (species not determinable). Mount Tilla, at 3000 feet.

Juncaginaceæ.

Potamogeton crispus, *L.*

Alismaceæ.

Alisma Plantago, *L.*
Sagittaria cordifolia, *Roxb.*

Orchidaceæ.

Zeuxine sulcata, *Lindl.*

Palmaceæ.

Chamærops Ritchiana, *Griff.* Very rare.
Phœnix dactylifera, *L.* Cultivated on river's bank; in some places quite naturalized, as at Pind-dadan Khan. Called "Kujoor."
—— sylvestris, *Roxb.* Mount Tilla, chiefly on its western slope.

Liliaceæ.

Allium rubellum, *Bieb.* Common over all the hills.
Asparagus Curillus, *Roxb.*
—— racemosus. *Willd.* Called "Eilora."
And other species.
Asphodelus fistulosus, *L.*
Scilla (species). At Bagree.

Commelynaceæ.

Commelyna Bengalensis, *L.*
—— communis, *L.*

Juncaceæ.

Juncus bufonius, *L.*

Cyperaceæ.

Cyperus Haspan, *L.*
—— mucronatus, *Roth.*
—— niveus, *Retz.* Called "Deela."
—— rotundus, *L.*
Eleocharis palustris, *Br.*
Eriophorum comosum, *Wall.* Mount Tilla and Salt Range. Called "Babeela." Used for making ropes.
Isolepis barbata, *Br.*
Scirpus maritimus, *L.*

Graminaceæ.

Æluropus repens, *Trin.* Characteristic of soil charged with saline matter. Commencing to the west of Jelallpore, where this begins, we lose *Cynodon Dactylon.*
Andropogon annulatus, *Forsk.*
—— Sorghum, *Brot.* Largely cultivated: called "Jowar."
Anthistiria anathera, *Nees.* Mount Tilla, over the whole hill.
Apluda aristata, *Roxb.*
Aristida depressa, *Retz.*
—— murina, *Cav.*
Arundo Donax, *L.* Cultivated, and also naturalized: used for basket-work.
Avena fatua, *L.*
Bambusa arundinacea, *Retz.* Mount Tilla, in a valley to the south-west. Called "Bansa." Quite wild.
Batratherum molle, *Nees.*
Bromus arvensis, *L.*
Chrysopogon serrulatus, *Trin.*
Cymbopogon laniger, *Desf.* Called "Babul."
Cynodon Dactylon, *Pers.*
Dactyloctenium Ægyptiacum, *Willd.* Called "Madana."
Digitaria sanguinalis, *Scop.* Thurknee.
Eragrostis cynosuroides, *Beauv.*
—— plumosa, *Link.*
—— poæoides, *Beauv.*
—— verticillata, *Beauv.*
Heteropogon contortus, *R. & S.*
Hordeum hexastichum, *L.* Cultivated largely. Called "Jhow."
Kœleria phleoides, *Pers.* If this grass were cultivated, it would be of great use during the cold weather for fodder.
Lappago biflora, *Roxb.*
Melanocenchris Royleana, *Nees.*
Oryza sativa, *L.* Cultivated near Pind-dadan Khan.
Panicum antidotale, *Retz.*
—— colonum, *L.* Also cultivated. Called "Shamack."

Panicum Petiverii, *Trin.*
—— procumbens, *Nees.*
Penicillaria spicata, *Willd.* Largely cultivated. Called "Bajree."
Pennisetum cenchroides, *Rich.*
Polypogon Monspeliensis, *L.*
Rottboellia glabra, *Roxb.*
Saccharum cylindricum, *Lam.*
—— Munja, *Roxb.* Also cultivated for making rope. Called "Moonj."
—— officinarum, *L.* Cultivated to some extent near Jelallpore. Called "Gunnah."
—— spontaneum, *L.* On the islands and ravines.
Setaria glauca, *Beauv.*
Triticum æstivum, *L.*, and vars. Called "Gehun." Largely cultivated.
Zea Mays, *L.* Cultivated chiefly as a garden crop. Called "Makhee."

Polypodiaceæ.

Adiantum Capillus-Veneris, *L.* In wells.
—— caudatum, *L.*
Asplenium Dalhousiæ, *Hook.* Mount Tilla: common.
Cheilanthes farinosa, *Kaulf.* Mount Tilla: common near the summit.

Marsileaceæ.

Marsilea quadrifolia, *L.*

On a remarkable Species of *Cissus* from the South of Benguella, with remarks on the *Ampelideæ* of Angola and Benguella. By Dr. Welwitsch, A.L.S.

[Read Dec. 17, 1863.]

Among the numerous groups of plants which more or less affect the physiognomy of the vegetation of Western Africa the Ampelideæ and Cissaceæ hold a prominent position. They are interesting also to phytographists, from the fact that the numerous species of *Cissus*, by their varied habit and mode of growth, characterize the three great botanical regions into which, in my opinion, the district of Angola and Benguella must be divided.

The entire number of species of Ampelideæ found by me in the above-named countries amounts to about forty, in which, however, are included two species of *Leea*, and a very remarkable plant which occurs upon the high sandy plains of the district of Ambaca, and which ought probably to constitute a new genus.

These forty species of Ampelideæ are spread over a space of

300 miles from east to west, commencing with the burning sandy steppes of the Atlantic coast region, and extending into the richly-wooded, cool, elevated plains of the interior. Throughout this space the number of species increases gradually, and the number of individuals becomes continually greater. With regard to their geographical distribution, it is found that the species with thick sappy fleshy stems preponderate in the littoral region (0–1000 feet alt.), those with elongated twining stems in the region of the primeval forests, and the species with upright, scarcely twining stems in the highest region of the elevated plains of the interior. Thus the species "*caule stanti*" are very rare in the littoral region, and are still more rare in the primeval-forest region, whilst almost all the species which are found in the region of the elevated plains exhibit a short upright stem, without any tendency to scramble or climb.

A second characteristic accompanying the geographical distribution of the Angola species of *Cissus* is the hairy covering of the stem and leaves. The species of the littoral region for the most part exhibit bright green, only slightly hairy stems and leaves, whilst the species of the primeval-forest region are characterized by dark-green shining foliage and more or less leathery, sometimes even evergreen leaves. On the other hand, in almost all the species of the region of the elevated plains, as for instance around Pungo-Andongo and Huilla, a thick hairy, or even felt-like, covering is seen on the stem and leaves. In a species which occurs upon the gneiss-rocks of Pungo-Andongo this latter covering forms such a thick golden-brown pile*, that the entire plant has the appearance of being hewn out of pure copper, and is indisputably one of the most beautiful of the vegetable productions of Angola. I have (provisionally) called this lovely species, which I believe to be undescribed, *Cissus Livingstoniana*, wishing thereby to indicate the fact (so important for geography) of this distinguished traveller having once visited Pungo-Andongo.

I purpose, with the kind permission of the Linnean Society, upon some other occasion, to lay before them this latter species, as well as the other notable forms or species collected by me in West Tropical Africa. For the present I confine myself to the description of a very remarkable species which occurs in the southernmost part of Benguella, in the district of Mossamedes, the same region where the Welwitschia grows†.

* Folia cupreo-velutina aureo-nitentia.

† The paper was accompanied by a living specimen (which has since flowered

AMPELIDEÆ.

Sectio Tetrandræ quinquefoliolatæ.

CISSUS MACROPUS, n. sp.

Arbor pygmæa, 1–2½-pedalis, tota succulenta. *Truncus* bulbum ingentem, ovato-conicum apice bi- rarius tri-brachiatum mentiens, cortice lævigato herbaceo-viridi et epidermate pergamentacea albo-badia tectum, lamellis epidermatis uti in *Betula* sensim sese decorticantibus. *Radix* e fibris longis, cylindricis, subsimplicibus constans. *Rami* breves ⅓- usque ½-pedales, 2–4 pollic. crassi apice demum abrupte in ramulos circiter pedales, foliis et floribus ornatos abientes. *Cirrhos* nullos hucusque observavi. *Ramuli* obiter striati, patentissimi et, uti folia atque petioli, villis albidis arachnoideis in juventute obsiti, demum glabrescentes, digiti crassitudine, et uti omnis planta succo aquoso scatentes. *Folia* (novella plicata albo-tomentosa) longe petiolata, infimum ramuli 3-, reliqua 5-foliolata, foliolis ovato-ellipticis vel obovatis, breviter petiolulatis, inæqualiter dentatis, utrinque arachnoideo-pubescentibus, supremum longius petiolulatum usque 4 vel 5 uncias longum, infima basi inæquilateralia, reliqua basi plus minus subcordata. *Stipulæ* ad basin petioli binæ, oppositæ, lato-lanceolatæ, acuminatæ, deciduæ. *Pedunculi* axillares vel abortu terminales, petiolorum circiter longitudine, leviter striati, patentes, petiolis tenuiores, dichotomo-ramulosi, ramulis oblique erectis corymbum latiusculum formantes. *Flores* 4-meri, ex flavo viridescentes, parvuli. *Calyx* brevissimus, obsolete dentatus, dentibus vix semper bene distinctis. *Corolla* tetrapetala, induplicato-valvata; petala carnosa apicibus induplicatis, per paria cohærentia, calyptratim decidua, apice valde cucullata, albida, sat fugacia. *Discus* valde evolutus, e tuberculis quatuor inter se distinctis columnaribus, apice oblique truncatis, ibidemque aurantiaco-glandulosis constans, post anthesin demum auctus. *Stamina* 4; antheræ obovatæ, incumbentes, luteolæ. *Ovarium* ovatum vel ovato-conicum disci tuberculis superatum, biloculare. *Stylus* sub anthesi staminum longitudine, firmus, rectus, stigmate simplici (nec capitato!) terminatus. *Fructum*, quem nondum observare mihi licuit, baccam esse dicunt, pisi mole, rubro-violaceum.

Hab. Sporadica in rupestribus (subsalsis!) de *Serra dos Montes Negros* prope Mossamedes, nec non in montibus aridis de *Giraul* versus orientem ad 400 usque 600 ped. altit. super mare.

Culta Olisipone floruit Apr. et Maio, quod est tempus autumni in ditione patriæ.

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at the Royal Gardens, Kew, and will be published by Sir W. Hooker in the Botanical Magazine for 1864) and a dried flower of the plant described.

Observations on the Functions and Structure of the Reproductive Organs in the *Primulaceæ*. By Mr. JOHN SCOTT, Royal Botanic Gardens, Edinburgh. Communicated by CHARLES DARWIN, Esq., F.R.S. & L.S.

[Read Feb. 4, 1864.]

IN the paper which I have the honour to submit to the Society, my principal object is to give an account of a few experiments, made chiefly in the course of the present year, on several of the "*dimorphic*" and "*non-dimorphic*" species of *Primula*, the remarkable sexual relations of which were entirely unknown until Mr. Darwin laid before this Society his interesting paper on the subject. I have also, with the view of more completely elucidating the subject of dimorphism in the Primulas, prefixed to these a brief account of the structure and indications of the resultant functions in a few other genera of the order, which may not be uninteresting, as apparently showing that those sexual relations manifested in the genus *Primula* are common to other genera of the order*.

1. The genus *Hottonia* presents dimorphic characteristics in at least its solitary British representative, the common Water-Violet, *H. palustris*. Of this plant I can say little from personal observations, but, through the kindness of Mr. Darwin, who obligingly sent me his manuscript account of it, I am enabled to add, from his observations, the following interesting account of its structural dimorphism:—"Various authors have remarked that the *Hottonia palustris* presents two forms. Fresh specimens sent to me from North Wales were grandly dimorphic. In the long-styled form the pistil is more than twice as long as in the other form, and projects far out of the flower; the stigma is smaller and rougher than that of the short-styled, and the anthers lie within the tube of the corolla. In the short-styled form the

* I will here take the opportunity to acknowledge my great obligations to Mr. M'Nab for the privilege I have, under him, enjoyed in carrying on the experiments which I am now about to detail, the majority of which were performed upon plants in the Royal Botanic Gardens here.

I am also in the present instance, as in many others, particularly indebted to Mr. Sterling, of Stockbridge, Edinburgh, for the facilities he has afforded me in the following out my experiments, by placing at my disposal his fine collection of plants.

anthers project far out of the flower, and correspond in height with the projecting stigma of the other form, as does the short pistil with the short stamens of the long-styled form. But the most remarkable difference is in the size of the pollen-grains: those from the short-styled flowers, when distended with water, are $\frac{14}{14000}$ of an inch in diameter; those from the long-styled (and therefore from the shorter stamens) are $\frac{9}{14000}$ in diameter. Spheres differing in the proportion of 14 to 9 in diameter presented under the microscope a most remarkable contrast. The contents of the larger pollen-grains seemed to be coarser-grained and of a browner colour."

To these structural observations of Mr. Darwin I may add a few experiments which I have lately had an opportunity of making upon a "short-styled" plant of this species, which, though worth little, afford more than a negative presumption that the above-described morphological peculiarities are also, as in the genus *Primula*, connected with remarkable functional relations. My experiments were limited to two racemes. In one I fertilized twelve flowers with own pollen; these yielded six capsules, *five* of which were good, and contained in all *thirty-seven* seeds. The other raceme I fertilized with pollen sent me of a long-styled form. The results from eight flowers thus fertilized were, *five good capsules,* and *one hundred and fifty-four seeds.* Thus, in the "*homomorphic unions*"—or union with own-form pollen—the average production of seeds per capsule is about *seven,* while in the "*heteromorphic union*"—or that resulting from the union of the two forms—we find the average of seeds per capsule increased to thirty and upwards.

Before passing from this genus, I may state that the *H. inflata* of North America does not present structurally dimorphic characteristics, however it may be as respects function. In specimens which I have examined, I found the style very short, and reaching the base of the anthers; the pollen-grains very similar as respects size, *i. e.* judging from dried specimens, to those of the "long-styled" form of *H. palustris.*

2. The genus *Primula* has, along with a great majority of truly "dimorphic" species, others in which I have observed the one form only; also a few with stamens and pistils of an equal length—"*non-dimorphic.*" In the following list I have enumerated all the species of *Primula* which I have had an opportunity of examining, and arranged them in accordance with my observations on the structure of their sexual organs. The first list

comprises the truly "dimorphic" species. They are as follows:—

No. 1. *Dimorphic Species.*

Primula Altaica, *Lehm.*
—— amœna, *Bieb.*
—— aretioides, *Lehm.*
—— Auricula, *Linn.*
—— capitata, *Hook.*
—— Carniolica, *Jacq.*
—— cortusoides, *Linn.*
—— denticulata, *Smith.*
—— elatior, *Jacq.*
—— farinosa, *Linn.*
—— Finmarchica, *Jacq.*
—— glaucescens, *Morett.*
—— glutinosa, *Linn.*
—— Helvetica, *Don.*
—— hirsuta, *Dec.*
—— integrifolia, *Linn.*
—— involucrata, *Walk.*
—— latifolia, *Lapeyr.*

Primula macrocalyx, *Bunge.*
—— marginata, *Curt.*
—— minima, *Linn.*
—— Pallinurii, *Petagn.*
—— Pedemontana, *Thom.*
—— petiolaris, *Wall.*
—— pubescens, *Jacq.*
—— purpurea?
—— Sibirica, *Jacq.*
—— Sikkimensis, *Hook.*
—— Sinensis, *Lindl.*
—— Stuartii, *Wall.*
—— stricta, *Horn.*
—— venusta, *Hook.*
—— veris, *Linn.*
—— villosa, *Jacq.*
—— viscosa, *All.*
—— vulgaris, *Smith.*

No. 2. *Short-styled Species.*

Primula floribunda, *Wall.*
—— Pallindhm?
—— pusilla, *Goldie.*
—— rosea, *Bot. Mag.*

Primula saxifragifolia, *Lehm.*
—— rupestris?
—— nivalis, *Pall.*

No. 3. *Long-styled Species.*

Primula intermedia, *Curt.*
—— Flœrkeana, *Schr.*
—— longifolia, *Curt.*

Primula Mistassinica, *Mich.*
—— Pallasii, *Lehm.*
—— pulverulenta?

No. 4. *Non-Dimorphic Species.*

Primula elata, *Hook.*
—— longiflora, *All.*
—— mollis, *Hook.*

Primula Scotica, *Hook.*
—— Sibirica, var. β, *Bot. Mag.*
—— verticillata, *Forsk.*

The first of the above lists comprises all the species of *Primula* in which I have observed the dimorphic characteristics in full; the two following are respectively enumerations of those species presenting, first, the *short-styled*, and second, the *long-styled* form only; but this may be due to my limited researches, and perhaps those who have an opportunity for more extensive researches will find them truly dimorphic likewise. Space will not permit, nor indeed is it requisite, that I should enter into details

as to the relative structure of the sexual organs of these species, and this the more especially because a few of them will come under special treatment in the sequel. I will here, therefore, simply remark, that the individual characteristics of all the above species, with two exceptions, were so decided as to leave no doubt as to which form they should be referred. The species which presented the exceptions were the *P. pusilla* and *P. floribunda*, in both of which along with normal "short-styled" forms I have observed an individual with stamens and pistils of an equal length. I have only seen six specimens of *P. pusilla*, five of which had the anthers surrounding the mouth of the corolla-tube, the pistil about half the length of the latter. In the other specimen the anthers were similarly attached, but in this case the stigma reached their base. The case of *P. floribunda* is exactly similar, one specimen having the stamens and pistils of an equal length; the others were "short-styled"—the anthers reaching the mouth of the corolla-tube, the pistils about half the length of the latter.

These lists then show us that "*dimorphism*" is a very general characteristic of the sexual organs of the species of *Primula*; it is not, however, *universal*, as Mr. Darwin informs me Prof. Treviranus has stated (Bot. Zeit. 1863, p. 4) on the authority of Koch and Tausch. This will be seen by referring to the fourth of the above lists, where the names are given of those species presenting, from personal observations, no structural dimorphism, stamens and pistils being of an equal length. I had no intention of entering into special details as to the relative structure of the sexual organs in these species; since the above diametrically opposite assertion, however, has been made, I cannot thus summarily pass them over. I will therefore give a brief account of the relations of the anthers and stigmas in each.

First, *Primula elata*.—Of this species a single specimen only has come under my observation. In it the stamens are attached immediately below the mouth of the corolla-tube, anthers included; the stigmas in a number of the flowers reach the middle, in the others the base of the anthers.

Second, *Primula longiflora*.—In this species the anthers invariably surround the mouth of the corolla-tube, the stigmas either very slightly exserted, or more frequently of an equal length with the anthers.

Third.—*Primula mollis* differs from its immediate allies the *P. Sinensis* and *P. cortusoides* (truly dimorphic species) in pre-

senting an equality in the length of the sexual organs. The anthers are attached to the tube of the corolla about one-third below its mouth, and closely surround the flattened disk-shaped stigma, which usually reaches their apices.

Fourth.—*Primula Scotica* affords us an indigenous illustration of the "non-dimorphic" structure. In native specimens I find the anthers usually surround the mouth of the corolla-tube, while in cultivated specimens I have in general found them attached about one-third below its mouth; in either case, however, the length of the style varies similarly, the stigmas in both being closely appressed by the anthers.

Fifth, *Primula Sibirica*.—Of this species two varieties are known, one with oblong entire leaves, the other with ovate crenated leaves. I have examined a number of native specimens of the former variety, all of which were truly dimorphic; of the latter I have seen cultivated specimens only, which, on the other hand, had stamens and pistils of an equal length. Whether native specimens of the latter are similarly characterized I know not; but it is not at all improbable that the "non-dimorphic" structure in the cultivated specimens is due to an abnormal development, as I have frequently observed flowers on distinct plants with the anthers assuming a petaloid form. Mr. Darwin in his paper above referred to (p. 81) mentions a case of non-dimorphism also in this species; he suggests, however, that it may possibly be due to an abnormal development of the anthers. Until further evidence is afforded of the structural condition of the *P. Sibirica*, var. β, from native specimens, I will therefore place it provisionally amongst the non-dimorphic species.

Sixth.—*Primula verticillata* is the last species which I have to notice as presenting the non-dimorphic structure. In wild and cultivated specimens I find exactly similar relations between the anthers and stigmas—the former attached to the upper third of the corolla-tube, and included, usually closely appressed to the stigma. I may state, however, that the length of the style is slightly variable (an occurrence which gives it a theoretical interest from its intimate affinity with the *P. floribunda* already noticed as a "*dimorphic*" species occasionally presenting individuals with a non-dimorphic structure); and though, as I have just stated, the stigma usually stands at an equal height with the anthers, it occasionally rises above them, or even becomes slightly exserted beyond the mouth of the corolla-tube.

These five species, then, with the variety of *Primula Sibirica* ?,

are non-dimorphic so far as structure is concerned: in respect to their functional performances, I will here merely remark that, from my experience, two of the above species, viz. *P. mollis* and *Scotica*, seem to be perfectly self-fertile; in respect to a third, *P. verticillata*, this is very doubtfully the case, as the experiments which I will give in a subsequent part of my paper will show. In the genus *Primula*, then, as in that of *Linum* already illustrated by Mr. Darwin, we have species structurally and functionally hermaphrodite, as well as species which, though hermaphrodite as to structure, have undergone such differentiations in their male and female sexual elements as to render their mutual functional action so highly imperfect, that they have been aptly designated "*subdiœcious hermaphrodites*." How the former of these, the "non-dimorphic," should have escaped the notice of such excellent observers as Koch and Tausch, I fail to understand; but I feel convinced that a careful re-examination of the species will certainly induce them to cancel the above statement, if indeed the evidence which I have already adduced and that which I have yet to lay before the Society is not sufficiently demonstrative.

3. *Gregoria* presents at least one structurally "dimorphic" species, *G. Vitaliana*: respecting the others I am in perfect ignorance, never having seen specimens. In the "stort-styled" form of *G. Vitaliana* the anthers reach the mouth of the corolla-tube, while the pistil is about half the length of the latter. In the "long-styled" plants the anthers are attached about one-third below the mouth of the corolla-tube, the pistil in this case being exserted beyond the latter and fully twice as long as in the "short-styled" form. The pollen-grains in both forms are very similar—of an ovoid or oblong shape: the stigmas likewise are nearly of the same shape in both forms, apparently rougher in the "long-styled"; but I cannot speak confidently as to this, having only had dried specimens of the latter form to judge from. In respect to the reciprocal functional relations of these forms, I have no knowledge; but I think the following experiments on the "short-styled" form fully justify us in predicating the existence of a functional dimorphism. Three plants on which I had an opportunity of experimenting produced in the course of the season twenty-one flowers, which I treated in the following manner: five were left to natural agencies; eight were fertilized with own pollen; the remainder (eight) were fertilized with pollen from one of the other plants. The results were the complete abortion of every capsule of the two former, while in the latter case two cap-

sules were produced, but these did not contain a single good seed. I may also state that, after inquiring of various cultivators of alpine plants, I cannot hear that this plant ever produces seed. In Primulas, Mr. Darwin has shown that the pollen of the "short-styled" form, relatively to its own stigma, is considerably more sterile than the "long-styled" by its own-form pollen: may we not, then, in the "short-styled" forms of *Gregoria Vitaliana* have analogous relations of the sexual elements? Anyhow, the above experiments render it highly probable that for the production of perfect fertility the conjunction of the two forms is absolutely necessary.

4. The genus *Cortusa* is remarkable, though not peculiarly so, in apparently presenting the structure of the "long-styled" form only. I have at least failed in discovering the other form after a careful examination of the fine suite of specimens contained in the Edinburgh University Herbarium, as well as those in a few private herbaria. I find it to be the case also with cultivated plants of the *C. Matthioli*, the only representative of the genus; and in the generic definition by Linnæus "*stylus filiformis, exsertus*" also occurs, so that it is highly probable that the one form only exists. I will now briefly describe the floral structure of the genus in so far as connected with the economy of fertilization. The corolla-tube is short, with the limb expanding upwards in a campanulate manner; the filaments short, scarcely half the length of the obcordately-acuminated, excurrent anthers; the style is nearly three times the length of the stamens, and projects beyond the corolla. A plant which I protected from insects, when in flower, did not produce a single seed: those, on the other hand, which I artificially fertilized were perfectly fertile. I may further state, from the experience of others, as well as my own, that the plants of this species cultivated in our gardens, and left to the casual agencies of nature, produce in general a very small quantity of seed,—a consequence, perhaps, of their being less attractive to insects under cultivation than in their native haunts; for, undoubtedly, perfect fertilization can only be effected by some such agencies.

5. I have already stated that the structural relations of the sexual organs in *Cortusa* are not peculiar to it. In the allied genera *Dodecatheon* and *Soldanella* very similar relations are exhibited between the anthers and stigmas, the latter projecting considerably, in the majority of the species, beyond the former,—an occurrence which, considering the systematic affinities of the three

genera, favours the opinion that *Cortusa* has the structure of the one form only. *Dodecatheon* and *Soldanella* are also perfectly fertile when artificially fertilized: neither, however, in general, produce much seed in our gardens when fertilization is left to the agencies of nature. *Dodecatheon* is particularly deceptive in this respect, and ofttimes dupes the inexperienced collector of its seeds in our gardens by producing a profusion of well-formed and apparently good capsules destitute of all but the merest rudiments of seeds. In passing, I may remark that these genera (*Cortusa*, *Dodecatheon*, and *Soldanella*) afford excellent illustrations of a fact particularly emphasized by Mr. Darwin (*vide* Linn. Journ. vol. vii. p. 77), viz., that the fertilization of plants is not indifferently dependent on the agencies of insects or the action of the wind, inasmuch as they show that in the absence of the insects which visit them in their native habitats, or their non-attractiveness to those which frequent their new habitats, the mere action of the wind effects little in the economy of their fertilization.

6. The other genera of the Primulaceæ which I have had an opportunity of examining have stamens and pistils of an equal length, though occasional specific exceptions are certainly found. The *Lysimachia nutans* (a species referred to the genus *Lubinia* by Link and Otto) I would more particularly refer to in illustration of this, and, indeed, as possibly presenting both forms. In the single specimen which I have examined, the pistil was included within the tube of the corolla; the stamens *exserted* fully one-third beyond the latter! This relative inequality in the length of stamens and pistils is remarkable in a twofold manner—first, on considering the very general if not universal equality of the length of these organs in the other species of the genus, and secondly, from the circumstance that in this instance the *stamens* are the projecting organs; whereas in all the other representatives of the order (which I have examined) exhibiting differences in the length of stamens and pistils, I have invariably found that the latter organ was the more projected—excepting of course the genus *Primula*, though I strongly suspect that here all the dimorphic species are reciprocally so.

I have now briefly noticed those genera of Primulaceæ in which dimorphism has been observed—*Hottonia*, *Primula*, and *Gregoria*. These, singularly enough, are arranged by authors in the foregoing sequence from recognized structural relations—are thus seen to have innate bonds of affinity as manifested by those remarkable functional relations of the male and female sexual

elements,—coincidences certainly not without an interest from a theoretical point of view. I have also noticed a few other genera, which, though not reciprocally dimorphic in structure, nevertheless present such relative inequalities in the length of their stamens and pistils, that certain external agents are absolutely necessary to induce anything like perfect fertility. In this arrangement of the sexual organs, then, it is evident that a better chance is afforded for the crossing of individuals than is the case in that arrangement where an equality in the length of the latter organs is observed. Thus nature presents us, as it were, with one of her simplest plans for effecting what Mr. Darwin on a thoroughly philosophical basis regards as one of the great ends gained by that more complex and novel plan in which she so differentiates the sexual elements of individual hermaphrodites, that the conjunction of these from distinct individuals is rendered imperative for the accomplishment of perfect fertility. In respect to the other genera of the order which I have examined, I observed nothing in the structural relations of the sexual organs worthy of special notice; this, however, is exclusive of the following genera, of which I know nothing—*Lubinia*, *Apochoris*, *Pelletiera*, *Asterolinum*, *Euparea*, and *Micropyxis*.

I will now give in detail my observations and experiments on several "*dimorphic*" and "*non-dimorphic*" species of *Primula*. The former of these, as previously stated, has been specially treated by Mr. Darwin, who, as might be expected, has left little for subsequent elucidation. This, indeed, is so much the case, that I fear my observations will do little more than show that the dimorphism manifested by those species to which Mr. Darwin's observations were directed is common to many more. It is, therefore, with no pretensions to originality that I venture to lay the following observations before this Society. However, as the phenomena of reciprocal dimorphism is comparatively new to science, further elucidations of it will not, I trust, be deemed superfluous.

Primula Auricula.—The dimorphic structure of this species has been fully described by Mr. Darwin, and we might anticipate, from the results of the few experiments he has made on this species, a functional dimorphism similar to that he has so ably illustrated in *Primula vulgaris*, *veris*, and *Sinensis*. I therefore had no intention of giving in detail the results of my experiments on the unions of the two forms of this species. My attention, however, has been lately directed to a tacit implication of the absolute sterility of the long-styled form. As this view is

certainly erroneous, I will give, for the satisfaction of those who have had no means of testing the point at issue, the results of my own experience. The following are the results from plants growing together in a bed and freely exposed to the visits of insects*.

	Number of plants.	Number of umbels produced.	Number of capsules produced.	Number of seeds produced.	Number of umbels.	Number of seeds.
Short-styled Auriculas	10	33	287	2734	50	4142
Long-styled Auriculas	10	41	323	1816	50	2215

Again, in the following table the results are given from plants carefully protected from insects; though in no way effecting their fertility, as I proved by artificial fertilization.

	Number of plants.	Number of umbels produced.	Number of flowers produced.	Number of seeds produced.
Short-styled Auriculas	6	26	263	104
Long-styled Auriculas	6	22	272	8

If we compare the seed-results in the former of the above tables, we see that the short-styled are the more fertile—exceeding the long-styled in about the proportion of two to one. Again, in the latter table we see that the short-styled forms are also the more productive, though, comparatively with the results from the exposed plants, extremely sterile, showing us clearly how much these plants are dependent for their fertilization on insects or other mechanical agencies. This is more especially the case in the long-styled plants whose stigma stands high above the stamens, so that pollen cannot possibly reach the stigma without mechanical aid. The seed-results of this form in my table were the product of a single umbel infested with aphides; and which I have no doubt were the fertilizing agents, as not a single seed was produced upon any of the others. In the case of the short-styled plants, on the other hand, a low degree of fertility may be pretty regularly effected: the stamens surrounding the mouth of the corolla-tube are more or less inclined inwards, so that the anthers

* This and the succeeding Tables are arranged after the manner of Mr. Darwin (*loc. cit.*). It will be observed, however, that instead of giving the weight of the seeds, as he has done, I have given their number. This alteration has been made at the suggestion of Mr. Darwin, who considers that greater exa ctitude is thereby attained.

lie over though high above the nearly sessile stigma, thus affording a great facility for the pollen falling upon it. Indeed, but for the coherent nature of the pollen-grains, which do not readily fall from the anthers, these short-styled Auriculas would very regularly yield an amount of seed equal to an ordinary homomorphic union.

I may here notice a fact with which I have only lately become acquainted, though I understand it has been long known to cultivators of the Auricula, viz. that if "alpine" Auriculas* are grown amongst other varieties, the seeds saved from the latter produce plants the majority of which present the characteristics of the "alpine" variety. So that the pollen of this variety apparently exercises a prepotent influence over that of the other varieties, as shown by its superior power of impressing likeness on the offspring. It would be interesting to know if the female element possesses a like prepotency in transmitting likeness when treated with the pollen of the others, or whether, as is more frequently the case in the crossing of species, this power runs more strongly in the one sex than in the other. Irrespective of this, however, we see—and the fact is highly interesting from its bearings on one of the alleged physiological differences between species and varieties—that varieties like species when crossed have occasionally an individual prepotency in transmitting likeness. To recur to our more immediate subject: in ignorance of the above knowledge respecting the dispersion of the pollen of "alpine" Auriculas, I was much surprised at the great fertility of a somewhat isolated long-styled "self"-Auricula†, the nearest to it being a short-styled "alpine" variety about four yards distant. The former of these plants produced a single umbel, every capsule of which was full of seed; and thus presented a marked contrast with the results I had previously got from long- and short-styled plants growing together in a bed. I have now no doubt, though I have not proved it by sowing the seed, that the increased fertility of the above plant was due to fertilization by pollen of the neighbouring "alpine" plant.

In the following table I have given the results of several artificial "homomorphic" and "heteromorphic unions" of yellow-

* A term applied by florists to those varieties of Auricula which have that portion of the flower immediately around the stamens of a yellow, and that exterior to this of different colours.

† The term "self" is applied by the florist to those varieties which have a circle of white surrounding the stamens, exterior to which is a broad single coloured border.

flowered varieties of *Primula Auricula* approaching closely the normal form of the species.

TABLE I.—*Primula Auricula.*

	Number of flowers fertilized.	Number of capsules produced.	Number of seeds produced.
Long-styled by own-form pollen (homomorphic union)	16	13	153
Long-styled by pollen of short-styled (heteromorphic union)	18	17	1245
Short-styled by own-form pollen (homomorphic union)	16	12	169
Short-styled by pollen of long-styled (heteromorphic union)	18	18	1764
SUMMARY.			
The two homomorphic unions	32	25	322
The two heteromorphic unions	36	35	3009

By reducing the figures of the two homomorphic and the two heteromorphic unions, we get the following proportions:—

	Number of flowers fertilized.	Good capsules produced.	Number of seeds produced.	Good capsules.	Seeds.
The two homomorphic unions	100	78	1004	100	1288
The two heteromorphic unions	100	97	8339	100	8597

This comparative tabulation of the different unions shows that the flowers of the two heteromorphic unions produce a greater number of good capsules and seeds than the flowers of the two homomorphic unions. The good capsules of the two heteromorphic unions yield more seed, in about the proportion of seven to one, than those from the two homomorphic unions! Again, if we refer to the different unions of the two forms given separately in the upper table, we see that the short-styled forms produce the most seed in both homomorphic and heteromorphic unions. Thus, taking the two homomorphic unions, we see that the average of seeds per capsule from the short-styled unions is fourteen, that from the long-styled unions scarcely twelve, or as seven to six. In the heteromorphic unions these proportions are increased, the short-styled forms averaging 98, the long-styled 73 seeds per capsule,—that is, nearly as eight to six. These results, though clearly showing that the short-styled unions in every case yield the greatest amount of seed, are nevertheless far from lending

any support to the opinion which I have already alluded to, *i.e.* the absolute sterility of the long-styled unions. This view seems to be entertained by Professor Treviranus, who states (Bot. Zeit. 1863, p. 6) that he found a plant of the long-styled *Primula Auricula* growing near a short-styled form, yet not one of the numerous flowers of the former produced a seed-capsule. We now know the absolute necessity for insect-agency in the fertilization of the long-styled form; hence, as I think, the observation of Professor Treviranus simply permits the inference that no insects had visited the plant. As all my results, however, have been obtained from less or more modified varieties of the *Primula Auricula*, whereas the observation of Professor Treviranus may possibly refer to the normal form of the species, objections may thence be taken to my regarding the former as correctly indicating the possible results of the latter. In view of such an objection, I can only add, that I have never had an opportunity of performing a single experiment on either form of the normal *P. Auricula*; but I can aver, from the examination of native specimens in herbaria, that the long-styled form *does produce capsules containing good seeds*.

As bearing upon this point, however, I may state that I never succeeded in getting a single good seed from homomorphic unions of the long-styled form of *Primula denticulata* *. I had also a few flowers sent of the short-styled form of this species, with which I fertilized a single umbel of the former; but in this case also, though a few capsules swelled, every seed was abortive. I do not, however, wish to be understood as positively inculcating the absolute sterility of this form; though, certainly, I can assign good reasons for so regarding cultivated plants under *homomorphic* treatment. Thus, in the Royal Botanic Gardens of Edinburgh there are at present a few dozens of plants of the *P. denticulata*, consisting exclusively of the long-styled form. Mr. M'Nab informs me that a varying number of these have been cultivated in the Gardens for upwards of eighteen years, yet, though affording annually a profusion of flowers, he has never known them to produce a single seed. This evidence is of course open to the objection that sterility in this case (as in that previously noticed) may

* This species presents the two forms; their long salver-shaped corollas exhibiting very marked differences from the positional changes in the attachment of the anthers. These are accompanied with other differences: the pistil in the long-styled form is fully four times as long as that of the short-styled; the stigma is also twice as long, and rougher; the pollen-grains smaller, but of a similar triangular shape in both forms.

be due to the absence of insects; but it is to be remembered that we have here, as already stated, experimental observations affording similar evidence. These, conjointly with the long-continued observations of Mr. M'Nab, fully justify our suspicions respecting the sterility of the long-styled form under cultivation. The phenomena of sterility, however, are truly so capricious, that but for the remarkable sexual relations of the dimorphic species of *Primula* (including, as some suppose, a possible tendency to the diœcious structure), such observations were entirely superfluous; and this the more especially, as I am now aware, from observations on native specimens in the Edinburgh University Herbarium, that the long-styled forms do produce seed. Those who believe that dimorphism is a step towards diœciousness, instead of attributing sterility in the present case to certain unnatural conditions, will naturally be inclined to suppose that by man's artificial treatment the development of the plan of nature has been accelerated, the phenomena of reciprocal dimorphism exhausted by the functional impotence of the female element of the hypothetical male, and the final step made to the complete separation of the sexes.

I have hitherto spoken of two forms only of the *Primula Auricula*, viz. the long- and short-styled; occasionally, however, in this as in other truly dimorphic species, a third form occurs with stamens and pistils of an equal length. This trifling structural difference of the latter is connected with very important functional differences, as we find it yields much more seed when self-fertilized than either homomorphic union. In the following table I will illustrate this by giving the results from a self-fertilized umbel of an equal-stamened and -styled form; besides these, I have also given the results from unions between the latter and the long- and short-styled forms.

TABLE II.—*Primula Auricula.*

	Flowers fertilized.	Number of capsules.	Number of seeds.
Equal-stamened and -styled form by own pollen	14	9	272
Short-styled union—pollen from the above	12	7	59
Long-styled union—pollen from the above	12	9	47

The sexual powers of this equal-stamened and -styled form have a twofold interest: first, when viewed comparatively with the pure homomorphic unions of the other forms; and secondly, when the

mutual sexual relations existing between it and the latter are taken into consideration. For the sake of illustrating these important points we will enter into a few comparative details. First, then, if we compare the results given in Table II. from the equal-stamened and -styled form when self-fertilized, with the most fertile of the homomorphic unions given in Table I., we see that the former produces more seed than the latter, the proportions being fully as two to one. Secondly, the results in Table II., from the short-styled form by the application of pollen from the form with stamens and styles of an equal length, afford an average of eight seeds per capsule, which is six seeds per capsule below the average homomorphic union of this form. Again, from the union of the long-styled form with the equal-stamened and -styled form, the average is reduced to five seeds per capsule, which is seven below the average produce of this form's homomorphic union. The lowest average of seeds is thus seen to be produced by the union of the equal-stamened and -styled with the long-styled form. This result I had partly anticipated from observations on the pollen-grains of the equal-stamened and -styled form, as I found that they agreed very closely with those characteristic of the long-styled form, and decidedly less than those of the short-styled form. From these results and observations, then, we may justifiably conclude, as Mr. Darwin has done from observations on a similar form (*loc. cit.* p. 80), that the equality in the length of the stamens and pistils was due to an abnormal development of the stamens, as shown by the relatively small grains of pollen they produced. We are thus afforded a tolerably satisfactory explanation for the decreased fertility remarked upon above, between the unions of this form and the long- and short-styled forms, in comparison with the homomorphic unions of the latter. There is yet, however, a most interesting fact, for which I can offer no explanation, namely, the high relative fertility of the equal-stamened and -styled form when fertilized with own pollen. We have seen that this form differs structurally from the long-styled form only in the place of attachment of the anthers, agreeing with it in the more important characteristics of the size of pollen-grains and stigma: physiologically, however, there is a marked divergence—an important functional adaptation in the relation of its own pollen to its own stigma.

No one has hitherto tested the influence of ***dimorphism*** on ***hybridism***; and now, having done with the individual and reciprocal relations of the sexual powers in the different forms of ***Pri-***

mula Auricula, I will, by way of illustrating the above phenomena, give the results of several experiments on the hybridization of *P. Auricula*. These are as follows :—

TABLE III.—Hybrid unions of *Primula Auricula*.

	Number of flowers fertilized.	Total number of capsules produced.	Number of good capsules.	Number of seeds produced.	Average number of seeds per capsule.
Primula Pallinurii, long-styled, by pollen of long-styled *P. Auricula**..............	6	4	4	265	66
P. Auricula, short-styled, by pollen of short-styled *P. viscosa*..........................	8	4	2	165	82
P. Auricula, long-styled, by pollen of short-styled *P. hirsuta*	8	4	3	168	56
P. Auricula, short-styled, by pollen of short-styled *P. hirsuta*	8	3	2	84	42
P. Auricula, long-styled, by pollen of the non-dimorphic *P. verticillata*	10	7	4	59	15

For the clear appreciation of the degree of sterility of the union of distinct species with the *P. Auricula*, relatively to the lessened fertility of the pure homomorphic unions as compared with the pure heteromorphic unions of the latter, I have made the following comparative tabulation (see Table IV. p. 94) of the results given in the Table of the hybrid unions, with those from the summary of the different unions of *P. Auricula* in Table I. :—

In the second column of the table, the calculated number of seeds is given of the hybrid unions of *P. Auricula* relatively to the hundred seeds produced by the pure heteromorphic unions of that species given in the first column. The fourth column contains a similar estimate of number of seeds by the homomorphic unions of *P. Auricula* relatively to the hundred by the hybrid unions given in the third column. If we compare the results, we see that the decreased fertility of the homomorphic unions rela-

* The scape of *Primula Pallinurii* met with an injury which prevented the perfect maturing of the seeds; nevertheless, from an examination of a number of them, I believe the above is a fair estimate of the good embryonated seeds. I may here state, as worthy a passing notice, that while the above long-styled plant of *P. Pallinurii* produced both a large percentage of good capsules and seeds when fertilized by pollen of *P. Auricula*, every capsule aborted of twenty-two flowers fertilized by own pollen, though the pollen-tubes freely penetrated the stigmatic tissue. We thus see—and the fact is most interesting—that while the female element of a long-styled *Primula* has become impotent to its own male element, it is yet susceptible of fertilization by the male element of a distinct species.

tively to the heteromorphic unions in *P. Auricula* exceeds more or less that of each of the four hybrid unions of that species. These are most formidable facts for those who look upon sterility as a special endowment to prevent the blending of organic forms. Utterly irreconcileable, indeed, with such an idea, they, on the other hand, plainly show "that sterility is not a specially acquired or endowed quality, but is incidental on other acquired and little-known differences," as Mr. Darwin has very properly urged.

TABLE IV.—Pure and hybrid unions of *P. Auricula*.

	Number of seeds produced by the heteromorphic unions of *P. Auricula*.	Number of seeds produced by the hybrid unions of *P. Auricula*.	Number of seeds produced by the hybrid unions of *P. Auricula*.	Number of seeds produced by the homomorphic unions of *P. Auricula*.
The heteromorphic unions relatively to the homomorphic unions of *P. Auricula*	100	...	...	15
The short-styled homomorphic union of *P. Auricula* by pollen of *P. viscosa* relatively to the pure unions of the former	100	96	100	16
The long-styled heteromorphic union of *P. Auricula* by pollen of *P. hirsuta* relatively to the pure unions of the former	100	65	100	23
The short-styled homomorphic union of *P. Auricula* by pollen of *P. hirsuta* relatively to the pure unions of the former	100	49	100	31
The union of long-styled *P. Auricula* by pollen of the non-dimorphic *P. verticillata* relatively to the pure unions of the former	100	17	100	87

In Table III. I have given the results of all my ***successful*** experiments on the hybridization of *Primula Auricula*: it is necessary, however, for the more complete elucidation of the influence of dimorphism on hybridism, that I also subjoin a few instances of my unsuccessful trials, in so far as connected with the reciprocal unions of those already given. First, then, by referring to Table IV. we see that the short-styled homomorphic unions of *P. Auricula* by pollen of *P. viscosa* are highly fertile; nevertheless I have completely failed to fertilize reciprocally *P. viscosa* by pollen of *P. Auricula*. I also failed to effect an heteromorphic union between these species: my experiments, however, in this case were limited to the long-styled *P. Auricula* by pollen of short-styled *P. viscosa*. Again, secondly, the long-styled heteromorphic and short-styled homomorphic unions of *P. Auricula* by pollen of *P.*

hirsuta are given in the table; but I have failed by either form pollen to effect the converse unions, *i. e.* fertilize the short-styled *P. hirsuta* by either form pollen of the *P. Auricula*. In the case of the long-styled form of *P. hirsuta* I utterly failed to effect a single union, though I tried it homomorphically and heteromorphically by the two-form pollens of *P. Auricula*, and also conversely by applying the pollen of the long-styled *P. hirsuta* to the two forms of *P. Auricula**. These few details then will enable us to consider, in part, the amount of parallelism existing between certain of the phenomena of hybridism in normal hermaphrodite species, and the hybridism of dimorphic species. In the fertilization of hermaphrodite species, several cases occur in which the male element of the one, A, for example, fertilizes the female element of the other, B, while the male element of B will not fertilize the female element of A: so in the hybridism of dimorphic species, with the important appanage of an increased complication of the conjunctive powers, we find analogous cases. Thus, let A *l* and A *s* and B *l* and B *s* respectively represent the long- and short-styled forms of the *P. Auricula* and *P. hirsuta* given above, then while the male element of A *s* fertilizes the respective female elements of B *l* and B *s*, that of A *l* cannot fertilize either of the latter; again, there is a mutual impotence between the male elements of B *l* and B *s* and the female elements of A *l* and A *s*. We thus see that a close parallelism exists between those remarkable phenomena occasionally observed in the reciprocal crossing of species on the one hand, and those observed in the reciprocal crossing of the two sexual individuals of a dimorphic species with those of a distinct dimorphic species on the other. In the latter case, as compared with the former, there is of course a greater complexity in the functional relations—eight crosses being possible between dimorphic species,—and so it is

* It may be advisable to state the number of flowers fertilized in each of the subjoined experiments:—First series, *P. Auricula* and *P. viscosa*: I fertilized eight flowers of the short-styled *P. viscosa* by pollen of the short-styled *P. Auricula*, and ten flowers of the long-styled *P. Auricula* by pollen of the short-styled *P. viscosa*. Second series, *P. Auricula* and *P. hirsuta*: of sixteen flowers of the short-styled *P. hirsuta*, one-half were fertilized by pollen of the long-styled, and the other by that of the short-styled *P. Auricula*; again, of the long-styled *P. hirsuta*, five flowers were fertilized by pollen of the long-styled, and five by that of the short-styled *P. Auricula*; in the converse unions of these, ten long-styled and ten short-styled flowers of the *P. Auricula* were fertilized by pollen of the long-styled *P. hirsuta*. Thus, including the three successful unions of these species given in Table III., we find that the above phenomena are the results of eighty-eight flowers, in each case carefully fertilized.

with the results, which are certainly most astounding; inasmuch as each of the sexual forms of a species manifest in their respective powers for conjunctions with those of another species, physiological peculiarities which might well entitle them, by the criterion of fertility, to specific distinction.

There is another interesting point illustrated by the above experiments upon which I will venture a few remarks—subject to the reservation, however, of their being modified by more numerous experiments. It is now perfectly well known that the two forms of several species of Primulas have their sexual powers so correlated, that while very imperfect fertility results from the fertilization of either form by own-pollen (a homomorphic union), perfect fertility results from the application of the pollen of the one form to the stigma of the other (a heteromorphic union). In the present instance, then, we are naturally led to inquire whether these correlations of the sexual powers in the two forms of a species extend in parallel lines to the two forms of a distinct species when hybridized? or are they limited in their operation to the individual forms of the species? In other words, in the hybridizing of dimorphic species, is the heteromorphic definitely more fertile than the homomorphic union? or is the alternative innately variable? Let us again, for a moment, recur to the above details and Table of hybrid unions for a little enlightenment on these queries. First, we see the short-styled *homomorphic union* of P. *Auricula* by pollen of P. *viscosa, highly fertile*; while of the other three unions tried between these species (*two heteromorphic* and *one homomorphic*), not one flower produced a seed-capsule! Again, secondly, successful results are derived from the long-styled *heteromorphic* and the short-styled *homomorphic* unions of *P. Auricula* by pollen of *P. hirsuta*,—the *heteromorphic* yielding more seed than the *homomorphic* in the proportion of 4 to 3. The other possible unions of these forms (three *heteromorphic* and three *homomorphic*) were also tried; but they did not produce a *single seed-capsule*! What now do these several experiments teach us respecting the points at issue? Looking to the successful experiments alone, we might be inclined to suppose, from the result of *P. Auricula* and *P. hirsuta*, that in the hybrid unions, as well as in the cross-unions of the two forms of a species, the *heteromorphic* were the more fertile,—even with the *remarkable fertility* of the *short-styled homomorphic unions* of *P. Auricula* and *P. viscosa* staring us in the face. On the other hand, if we take a general view of the evidence, and carefully balance and

reflect on the results, I think we are all but forced to conclude that the parallelism noticed above is accidental*, and that, even as the greatest capricity and uncertainty is manifested in the sexual conjunctions of the respective forms, so is there a like capricity and uncertainty in the degree of fertility thereby induced. In fine, as there is a general indefiniteness in the results of the reciprocal unions of normal hermaphrodite species, so I believe (as above indicated) we shall find similar irregularities in the results of the reciprocal unions of the two forms of dimorphic species.

Primula vulgaris and the var. *alba* present both forms; of the *P. vulgaris*, var. *rubra*, I have seen the long-styled form alone. I instituted a series of experiments on these forms, with the view of determining the results of their reciprocal unions. Certain of these are so remarkable, that I hesitate not a little in bringing them forward until I have had again an opportunity of repeating my experiments. From their bearings, however, on certain highly important points in theoretical natural science, I will (subject to the above reservation) venture to lay the results before the Society, and thus directing the attention of those interested in such phenomena to subjects well worthy a careful experimental examination, show also that my results, remarkable though they undoubtedly are, have a basis sufficiently extensive to justify me in regarding them as at least an approximation to the true functional relations of these plants.

In the following Table I have given the results of my experiments on several plants of the above varieties, growing in pots and subjected to exactly similar treatment:—

* The necessity for further experimentation on this point, however, is shown by the following cases mentioned by Mr. Darwin, 'Origin of Species,' 3rd edit. p. 293, on the authority of Gärtner: "namely, that yellow and white varieties of the same species of *Verbascum* when intercrossed produce less seed than do either coloured varieties when fertilized with pollen from their own coloured flowers." Again, "that when yellow and white varieties of one species are crossed with yellow and white varieties of a DISTINCT species, more seed is produced by the crosses between the similarly coloured flowers than between those which are differently coloured." We thus see that the functional relations of varieties of a species MAY extend to, and similarly correlate the varieties of DISTINCT species!

TABLE V.—*Primula vulgaris*, and vars. *alba* and *rubra*.

	Number of flowers fertilized.	Total number of capsules produced.	Total number of good capsules produced.	Number of seeds produced.	Average number of seeds per capsule.
Primula vulgaris, var. *alba*, short-styled unions:—					
Homomorphic unions	14	10	8	106	13
Heteromorphic unions	12	10	10	206	21
Primula vulgaris, var. *alba*, long-styled unions:—					
Homomorphic unions	10	8	5	56	11
Heteromorphic unions	10	9	8	155	19
Primula vulgaris, var. *alba*, by pollen of *P. vulgaris*, short-styled unions:—					
Homomorphic unions	10	8	6	27	4
Heteromorphic unions	10	7	7	103	14
Primula vulgaris, var. *alba*, by pollen of *P. vulgaris*, long-styled unions:—					
Homomorphic unions	8	6	5	24	5
Heteromorphic unions	8	6	6	112	17
Primula vulgaris, by pollen of *P. vulgaris*, var. *alba*, short-styled unions:—					
Homomorphic unions	10	8	7	35	5
Heteromorphic unions	10	7	7	116	17
Primula vulgaris, by pollen of *P. vulgaris*, var. *alba*, long-styled unions:—					
Homomorphic unions	10	8	6	28	5
Heteromorphic unions	10	9	8	150	19
Primula vulgaris, var. *rubra*, long-styled union:—					
Homomorphic union	14	11	11	159	14
Primula vulgaris, var. *rubra*, long-styled, by pollen of *P. vulgaris*:—					
Homomorphic union	12	0			
Heteromorphic union	12	0			
Primula vulgaris, var. *rubra*, long-styled, by pollen of *P. vulgaris*:—					
Homomorphic union	8	0			
Heteromorphic union	8	0			

It may perhaps be desirable that the Society should have a detailed account of my experiments on effecting unions between the *P. vulgaris*, var. *rubra*, and the others, viz. *P. vulgaris*, and var. *alba*. As in that above given, the remarkable results are alone stated—the absolute zero of fertility, apparently, attained between undoubted varieties of a species!* By way of a preliminary to the

* The pure descent of the red and white Primrose from the common yellow has been questioned, and a hybrid origin from the Cowslip and Primrose (*P. veris* and *P. vulgaris*) ascribed to them. To my mind, the latter view is negatived by the results given in the above table. It is there shown that both (red and white) forms are, relatively to the results of similar unions with the common

special account of experiments, it is necessary to state that the red Primrose rarely ever, in its own natural state, produces a single seed—a peculiarity possessed in common with the above-mentioned white variety. Both of these varieties, Mr. M'Nab informs me, have been cultivated in the Botanic Gardens of Edinburgh for a number of years; yet, previous to this season, he has not known them to produce a single seed. With the view of satisfying myself as to the absolute sterility of these plants, I instituted a series of experiments, the results of which show that this is only partly correct,—certain individuals being perfectly fertile, others absolutely sterile, pollen being carefully applied to both. This is shown by the following experiments:—First, I selected a few fine vigorous-growing plants of the red and white varieties, and continued for some time regularly fertilizing the flowers as they were successively developed. I feel certain that I thus fertilized upwards of two hundred flowers without getting a single seed! Secondly, I directed my experiments to those plants which, with a less vigorous habit, produced a greater profusion of blooms. These I found to be alone productive—at least when artificially fertilized—for they seem to be equally as sterile as the others when fertilization is left to natural agencies: perhaps they are less sought after by insects than the common yellow Primrose. Anyhow, I have failed to detect a single seed on those plants in the Botanic Gardens of Edinburgh, which had proved fertile by artificial treatment, on leaving them to the agencies of nature. Those plants of the red and white Primrose, stated in the above table to yield such remarkable results, were also proved *susceptible* of *artificial fertilization* with *own pollen, both before and after I had repeatedly failed in effecting good results from cross-unions between them*, and also between *them* and the *common Primrose: every capsule thus treated*, singularly enough, *proved abortive*! However these results then may be modified by future experimentation, the following important conclusion will remain unaffected, namely, that plants of the *P. vulgaris*, var. *rubra*, characterized, as we have already shown, by the most capricious and uncertain performance of their sexual functions, nevertheless *proved fertile when treated with own pollen*; AT THE SAME TIME that *similar ex-*

Primrose, perfectly fertile *inter se*; whereas by their unions with the latter we see in the one case a relatively decreased fertility, in the other absolute sterility resulting! How utterly inconsistent, then, are such results with the idea of hybridity! In consonance with a hybrid origin, an increased instead of a decreased fertility ought to have resulted from the latter unions.

perimentations upon them with the *pollen* of the *parental form* (*P. vulgaris*), and likewise *that* of the other *modified descendant* (*P. vulgaris*, var. *alba*) *resulted in the abortion of every seed*! Such then are the experimental data from which the remarkable results stated in the latter part of Table V. were derived. That they are not sufficiently numerous to demonstrate the *unconditional* existence of an absolute sterility between two modified descendants from a common parent, and also between the latter and one of the former, I have already admitted; nevertheless I think they clearly demonstrate the *conditional* existence of physiological divergences sufficient in extent to induce complete sterility. How, I ask, on any other grounds than by the admission of the conditional existence of such physiological divergences can we explain the phenomena in question,—namely, the existence of plants *perfectly fertile* when their flowers are *fertilized* by *own pollen*, and yet, at the same time, yielding naught but abortive results from those flowers fertilized by the pollen of the other variety and by that of their common parent?

I will now reduce, for the sake of comparison, the figures of the different unions given in Table V.; first of the long- and short-styled homomorphic unions, and second, of the long- and short-styled heteromorphic unions.

TABLE A.—*Primula vulgaris* and vars. *alba* and *rubra*.

	Number of flowers fertilized.	Number of good capsules.	Number of seeds.	Number of good capsules.	Number of seeds.
LONG-STYLED HOMOMORPHIC UNIONS.					
P. vulgaris, var. *rubra*, by own-form pollen...	100	78	1124	100	1445
P. vulgaris, var. *alba*, by own-form pollen ...	100	50	560	100	1120
P. vulgaris, var. *alba*, by pollen of *P. vulgaris*	100	62	297	100	480
P. vulgaris by pollen of *P. vulgaris*, var. *alba*	100	60	280	100	466
SHORT-STYLED HOMOMORPHIC UNIONS.					
P. vulgaris, var. *alba*, by own-form pollen ...	100	57	755	100	1325
P. vulgaris, var. *alba*, by pollen of *P. vulgaris*	100	60	270	100	450
P. vulgaris by pollen of *P. vulgaris*, var. *alba*.	100	70	350	100	500

TABLE B.—*Primula vulgaris* and var. *alba.*

LONG-STYLED HETEROMORPHIC UNIONS.					
P. vulgaris, var. *alba*, by own-form pollen ...	100	80	1550	100	1937
P. vulgaris, var. *alba*, by pollen of *P. vulgaris*	100	75	1400	100	1866
P. vulgaris by pollen of *P. vulgaris*, var. *alba*	100	80	1500	100	1875
SHORT-STYLED HETEROMORPHIC UNIONS.					
P. vulgaris, var. *alba*, by own-form pollen ...	100	83	1709	100	2060
P. vulgaris, var. *alba*, by pollen of *P. vulgaris*	100	70	1030	100	1471
P. vulgaris by pollen of *P. vulgaris*, var. *alba*	100	70	1160	100	1657

In the comparative tabulation of the long-styled homomorphic unions (Table A.), I have assumed, in the first column, that 100 flowers were fertilized, and in the two columns to the right of this, given the relatively increased proportions of capsules and seeds; again, the right-hand column gives the calculated results from an assumed 100 of good capsules. If we compare the results, we see, first, that the short-styled form of *P. vulgaris*, var. *alba*, yields more seed, in about the proportion of 13 to 11 seeds per capsule, than those of the long-styled form, while the long-styled *P. vulgaris*, var. *rubra*, again exceeds the former in about the proportion of 14 to 13 seeds per capsule. In the reciprocal homomorphic unions of *P. vulgaris* and the variety *alba* we see some little discordance in the results: thus, the most productive union is the short-styled homomorphic union of *P. vulgaris* by pollen of *P. vulgaris alba*, whereas the least productive of the four is the converse union of these forms. Again, in the long-styled homomorphic unions most is yielded from the unions of *P. vulgaris alba* by pollen of *P. vulgaris*; so that the *most fertile* of the *long-* and *short-styled crosses* are thus seen to *result from converse unions*, namely in the former case from *P. vulgaris alba* by pollen of *P. vulgaris*, in the latter from *P. vulgaris* by pollen of *P. vulgaris alba*!

In the comparative tabulation of the long-styled heteromorphic unions (Table B.) a similar arrangement is observed to that in Table A. The calculated results of these unions also show that the short-styled form of *P. vulgaris alba* when fertilized by own pollen is the more fertile, exceeding the similar long-styled union in the proportion of 20 to 19 seeds per capsule: compared with the short-styled *homomorphic* the proportions are as 20 to 13 seeds per capsule, or as 4 to 3 in favour of the long-styled *heteromorphic*. This relative accordance of the degrees of fertility resulting from similar homomorphic and heteromorphic unions when these are

treated by *own pollen* does not extend itself to the *cross-unions* of the different forms, the relative degree of fertility of the similar homomorphic and heteromorphic *cross-unions* being very irregular. Thus, in Table B., the *long-styled heteromorphic cross* of *P. vulgaris* by pollen of *P. vulgaris alba* yields more seed than that of the *similar* short-styled heteromorphic cross, in nearly the proportion of 19 to 17 seeds per capsule. In the converse unions of these, the long-styled heteromorphic cross of *P. vulgaris alba* also exceeds the similar short-styled heteromorphic cross, in about the proportion of 19 to 15. Again, in Table A. we see the highest degree of fertility resulting from the converse union of that in Table B., namely the short-styled homomorphic cross of *P. vulgaris* by pollen of *P. vulgaris alba*. In the long-styled homomorphic as compared with the long-styled heteromorphic unions, the highest degree of fertility is also the result of the converse unions of *P. vulgaris* and *P. vulgaris alba*! This discordance in the results of the different crosses surprised me much, though perhaps, after all, I had no right to expect perfect accordance or definite results from the reciprocal unions of normal individuals of a species, which consequently had a long-acquired morphological *status*, and of those from incipient or unestablished forms.

There is another point in the above tables to which I wish particularly to draw attention, namely the decreased proportion of seeds resulting from the cross-unions of *P. vulgaris* and *P. vulgaris alba*, relatively to the pure unions of either form. Thus, if we look to the short-styled heteromorphic unions, we find the *P. vulgaris alba* yielding with its own pollen above 20 seeds per capsule, while with the pollen of *P. vulgaris* it scarcely yields 15 seeds per capsule—that is, nearly as 2 to 3! Again, in the corresponding table of the homomorphic unions we find these proportions increased,—namely, *P. vulgaris alba* by own pollen yielding about 11 seeds per capsule, and by pollen of the *P. vulgaris* about 5 seeds per capsule, thus giving the proportions of 2 to 1! Such results as these from plants presenting no other appreciable difference than that of colour well exposes the slippery foundation of that dogma of natural science which would have us believe that nature had specially endowed organic beings with sterility to prevent the blending of specific types. These illustrations of sterility, in conjunction with those remarkable revelations of dimorphism, in which the sexual organs of a hermaphrodite individual undergo such great differentiations with respect to their

mutual action, might certainly suffice to show that sterility is not a special endowment, but a necessary result of secondary causes, which have no connexion whatever with special ends in the development of the classifying principle.

With my experiments in crossing *P. vulgaris* with *P. veris* I was most unfortunate; all my experimental plants met with an accident, and thus provokingly disappointed me of the results of my work. But for the kindness of Mr. Darwin, who, when I made him aware of my misfortune, obligingly sent me the following table, comprising the results of his experiments on the crossing of these species, I should have been entirely unable to illustrate this important part of my subject. With the exception, then, of the two first unions (the few results derived from my own experiments), all the others in the following table have been afforded me by Mr. Darwin.

TABLE VI.—Cross-unions of Primroses, Cowslips, and Polyanthuses.

	Number of flowers fertilized.	Total number of capsules.	Number of seeds.	Average number of seeds per capsule.	By calculation. Good capsules.	By calculation. Number of seeds.
Long-styled Cowslip by pollen of Primrose:						
Homomorphic union	8	3	33	11	50	550
Heteromorphic union	8	0	0	0		
Long-styled Primrose by pollen of Cowslip:						
Homomorphic union	3	2	20	10	50	500
Heteromorphic union	3	0	0	0		
Long-styled Primrose by pollen of Polyanthus:						
Homomorphic union	5	0	0	0		
Heteromorphic union	5	2	53	26	50	1325
Short-styled Primrose by pollen of Cowslip:						
Homomorphic union	3	0	0	0		
Heteromorphic union	3	3	142	47	50	2366
Short-styled Primrose by pollen of Polyanthus:						
Homomorphic union	4	2	32	16	50	800
Heteromorphic union	4	1	28	28	50	1400

The results of certain unions in this table are most interesting in their bearings on the general phenomena of sterility, and particularly from the excellent illustrations they afford of the extraordinary complexity of the laws of hybridism. We shall best appreciate their bearings on these phenomena, however, by the

following comparative details of the results given in the table. In the first place we shall see, as to the relative degrees of fertility resulting from the homomorphic and heteromorphic unions in each of the crosses:—1. In the *homomorphic unions* of the long-styled Cowslip by pollen of the common Primrose the results are 11 seeds per capsule, whereas from an equal number of flowers fertilized HETEROMORPHICALLY every seed-capsule aborted! 2. In the converse unions of these (the long-styled Primrose by pollen of the Cowslip) the results are singularly accordant, the *homomorphic unions* yielding an average of 10 seeds per capsule, while in the HETEROMORPHIC *unions* every seed-capsule is *again abortive*! 3. The *heteromorphic unions* of the long-styled Primrose by pollen of the Polyanthus yield an average of 26 seeds per capsule, and the *homomorphic unions* are utterly sterile. 4. Both unions of the short-styled Primrose by pollen of the Polyanthus are *highly fertile*; the *heteromorphie* also exceeding the *homomorphic unions* in the proportion of 28 to 16 seeds per capsule—that is, as 5 to 3 *. 5. And, lastly, we find that the *heteromorphic unions* of the short-styled Primrose by pollen of the Cowslip are remarkably fertile, yielding an average of 49 seeds per capsule; the *homomorphic unions*, on the other hand, do not yield a single seed!

We have already adduced a few illustrations of the functional relations of the two forms of one species with those of another species, and also expressed our belief, from the teachings of those illustrations, that the RELATIVE *sexual powers* of the two forms of a species did not extend to, or govern the *results* of *unions* between the *respective forms* of two distinct species. How fully, then, are we supported in this view by the results given in the above table! how unequivocally do they show us that functional dimorphism is limited in its operations to the *individuals* of a species! † It is curious to observe how this is borne out by our experiments on the *P. vulgaris* and its modified descendants. Thus, in the above reciprocal unions of Primroses and Polyanthuses, the *heteromorphic unions* in *both* cases exceed

* Mr. Darwin, in his letter to me accompanying the above results, remarks that the seeds of this short-styled Primrose were very small; so that we may perhaps suspect a number of them unfit for germination.

† It is highly probable indeed, from the results of the red Primrose (*vide* Table V.), that we may yet have illustrations of the fertile unions of the modified descendants of a species in which the laws of dimorphism may not be observed, and thus have cause to give *it* even a more restricted field of operation.

the *homomorphic unions*; and so we find it to be in all the unions of the common Primrose with the white variety given in Table V. Though there are certainly great irregularities as to the *grade* of fertility of the different unions, we have still extending through all, the important parallelism that the *heteromorphic* unions in every case exceed the *homomorphic* unions. We thus see (and the fact is most interesting) that though the *Polyanthus* and *White Primrose* have been greatly differentiated with respect to their sexual relations with their common parent, *P. vulgaris*, it is yet insufficient to derange the operations of the laws of dimorphism by rendering the heteromorphic and homomorphic unions indifferently the more fertile. By comparing the relative fertility of the different cross-unions of these forms, however, we are forcibly impressed with the occasional unimportance of structural differences on the functional correlations of distinct forms. Who, for example, in absence of proof, would have suspected that unions between the Polyanthus and the common yellow Primrose would afford a higher grade of fertility than those of the latter (the common Primrose) with the red and white Primroses, which, so far as can be discerned, differ from each other in colour alone? Nevertheless such is the case: we have shown that the red Primrose will not unite with *either* the yellow or white Primrose, and that a very imperfect fertility results from the unions of the two latter forms,—the *united heteromorphic unions* of the common Primrose by pollen of the Polyanthus producing more seed than the *similar unions* of the *former* by pollen of the white Primrose, in about the proportion of twenty-seven to eighteen seeds per capsule, or as three to two!

I have previously stated that individuals of truly dimorphic species occasionally appear with stamens and pistils of an equal length; and also gave an instance of the occurrence of such an individual in *P. Auricula*, with the results of experiments illustrating the effects of such a structure on the functions of reproduction. I will now give an additional and much more remarkable illustration of this from my observations on *P. veris*. Amongst a number of seedling Cowslips I observed an individual with stamens and pistils of an equal length, both reaching the mouth of the corolla-tube. On examination, however, I found it to differ importantly from the non-dimorphic individual of *P. Auricula*. The pollen-grains were as large as, or even larger than, those of normal short-styled plants: the stigma globular, and rough with papillæ,—in fact, a perfect *fac-simile* of that characteristic of

the long-styled form! These remarkable relative transpositions in the structure of the sexual organs are, as I will almost immediately show, connected with equally remarkable changes in the functions of reproduction. This will be seen by consulting the following table, comprising the results of nine distinct unions between the three sexual forms.

Table VII.—The Three Sexual Forms of *Primula veris.*

	Number of flowers fertilized.	Total number of capsules produced.	Number of good capsules.	Number of seeds.	Average of seeds per capsule.	By calculation. Good capsules.	By calculation. Number of seeds.
Red Cowslip, non-dimorphic form, 21 flowers self-fertilized	...	16	13	447	34	50	1719
Red Cowslip, non-dimorphic form, by pollen of long-styled Cowslip	5	3	2	15	7	50	375
Red Cowslip, non-dimorphic form, by pollen of short-styled Cowslip	4	3	3	27	9	50	450
Long-styled Cowslip by pollen of non-dimorphic Red Cowslip	5	5	4	22	5	50	275
Short-styled Cowslip by pollen of non-dimorphic Red Cowslip	5	4	4	16	4	50	200
Long-styled Cowslip, homomorphic union	10	6	5	83	16	50	830
Long-styled Cowslip, heteromorphic union	10	9	7	196	28	50	1400
Short-styled Cowslip, homomorphic union	7	5	5	58	11	50	580
Short-styled Cowslip, heteromorphic union	7	7	7	145	20	50	1035

In the first line of the above table the results are given of twenty-one flowers naturally fertilized of the equally-stamened and -styled Cowslip; the second to fifth, inclusive, give the results of the reciprocal crosses of the preceding form with the long- and short-styled forms. I have also added, for the sake of comparison, the results of the homomorphic and heteromorphic unions of the latter forms of *P. veris.* If we examine the results given in the fifth column of the table (in which the average of seeds per capsule is shown), we shall see that the highest grade of fertility results from the *self-union* of the *form* with *stamens* and *styles* of an equal length; thus, relatively to the most highly fertile of the other unions given in the table, viz. the long-styled heteromorphic union, we see that the average excess in favour of the former is thirty-four to twenty-eight seeds per capsule, or as five

to four!* A most remarkable contrast is afforded when we compare the fertility of the form with stamens and styles of an equal length with that resulting from the homomorphic unions; thus, taking the long-styled as the more fertile of the homomorphic unions, we see that the average excess of seeds per capsule in favour of the former is eighteen, affording the proportions of two to one! In the four reciprocal unions of the *long-* and *short-styled* forms with the *non-dimorphic* form, the results are remarkably complicated. Thus, the *non-dimorphic* form by pollen of the *long-styled* form yields an average of seven seeds per capsule; and by the converse union, *i. e.* pollen of the former applied to the stigma of the latter form, the average of seeds per capsule is reduced to five, or as four to three. Again, the *non-dimorphic* form by pollen of the *short-styled* form yields an average of nine seeds per capsule, whereas from the converse union the average is only four seeds per capsule—that is, as two to one! In these illustrations we clearly see that a complete derangement of the normal dimorphic relations of the two forms in their converse unions has been effected; thus the short-styled form used as female with the non-dimorphic form yields the lowest grade of fertility—four seeds per capsule, whereas used as male with the non-dimorphic form the highest grade of fertility is afforded—nine seeds per capsule! It is also worthy of notice that the *non-dimorphic* in *both unions* as *female*, with the long- and short-styled forms, exceeds in fertility the converse unions in about the proportion of two to one! The fertility of all these cross-unions, relatively to the pure unions of the long- and short-styled forms, is greatly decreased. Thus the *united short-styled* pure *homomorphic* and *heteromorphic unions* yield more seed, in about the proportion of *three* to *one*, than those from the *united cross-unions* of the *long-styled* and *non-dimorphic form*! Again, we find a great increase in the proportions by making a similar comparison of the pure *long-styled homomorphic and heteromorphic unions* with the *cross-unions* of the *long-styled* and *non-dimorphic* form, the average in this case being as *five* to *one*!

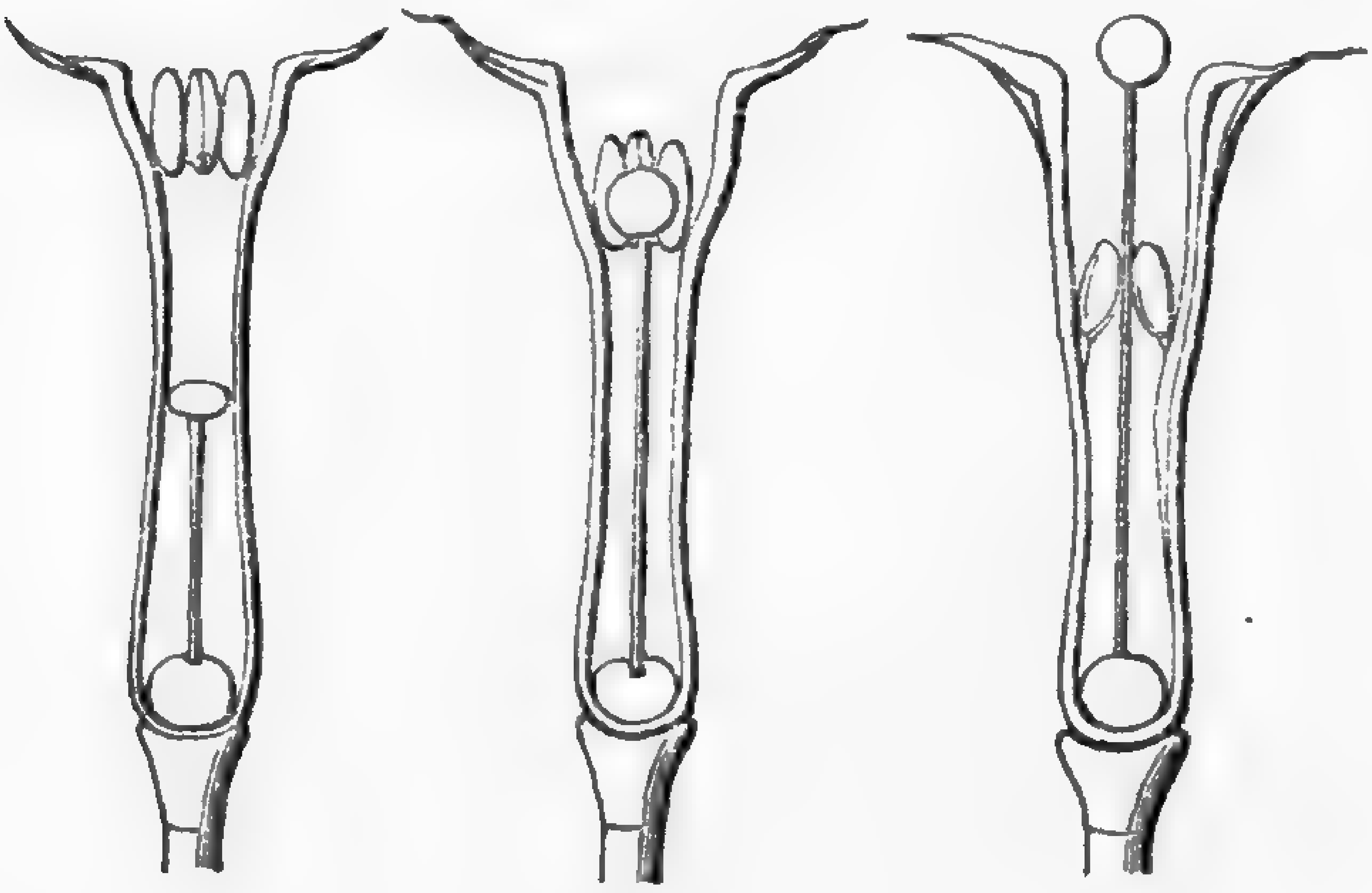
We thus see that the above Cowslip, structurally characterized, as I have previously stated, by an equality in the length of the stamens and styles, and in the resemblance of the pollen-grains and stigmas to those respectively characteristic of the long- and

* Mr. Darwin informs me those individuals of the *P. Sinensis* which have stamens and styles of an equal length are also more fertile with own pollen than a heteromorphic union!

short-styled forms, has also such functional characteristics as render it a normal hermaphrodite representative of the species! We also see that the pollen-grains and stigmas of this non-dimorphic form have become so differentiated with respect to their reciprocal action with those of the long- and short-styled forms, that a *grade* of *sterility* is induced greatly in excess of that which results from the homomorphic relatively to the heteromorphic unions of the latter forms! Now, Mr. Darwin has shown (and my experiments fully confirm it, *vide* Table IV.) that this lessened relative fertility of the homomorphic unions exceeds that resulting from the hybridism of several distinct species relatively to the pure union of those species. In view of such evidence, I think I am fully justified in adding that this *non-dimorphic* form is, in fact, judged by the physiological test so much insisted on by Prof. Huxley, *a new and distinct species*. Here we have an individual differing in colour, and likewise in important points of structure, from either of the forms which at present represent the species. Again, judged by the physiological test, we find a higher degree of sterility resulting from its unions with the two normal forms of the species, than that which results from the unions of other distinct species of Primulas! Certainly then, structurally and physiologically considered, this individual is perfectly entitled to specific honours. One class of naturalists would, indeed, readily admit the validity of such a claim if they had evidence of a constant recurrence of these characteristics; but there is another class which consider ignorance of origin a necessary appanage to this claim!

The foregoing experiments and observations on the non-dimorphic plant were made during its first or spring-flowering period, throughout which, as I have previously stated, a very constant equality was observed in the relative lengths of stamens and pistils in the flowers produced. A similar equality was observed in the relative lengths of these organs in the few flowers produced in its second or autumnal flowering; lately, however, it has produced an umbel in which the relative lengths of these organs in the respective flowers are so singularly variable that I have thought it worth while to give the measurements of each, as well as sketches of a few of the most distinct; thus:—

Number of flowers.	Length of stamens, in lines.	Length of pistils, in lines.
1	8	5
2	8	$8\frac{1}{4}$
3	$7\frac{1}{4}$	7
4	6	8
5	7	$8\frac{1}{4}$
6	6	7



1. 3. 4.

The numbers attached to the sketches correspond with those in the table of measurements. In the first case (No. 1) the structure is normally short-styled—stamens reaching the mouth of the corolla, pollen-grains large. In the second case (No. 3) the length of the stamens and pistils is nearly equal, and in this respect present the normal non-dimorphic characteristics of the plant, differing from it, however, in both (organs) being shorter than the tube of the corolla, and likewise in the greater variability of the size of the pollen-grains, which, upon the whole, are smaller than those produced by normally structured flowers. Again, in No. 4 we have an approximation to the long-styled structure—the stamens attached somewhat above the middle of the corolla-tube, while the stigma slightly projects from its mouth. The pollen-grains of this flower were plainly smaller than those from any of the other flowers, though undoubtedly more variable in size than those characteristic of the normal long-styled form.

In respect to the functional results of these flowers by fertilization with own pollen I cannot as yet speak, the capsules not being sufficiently matured. Nevertheless I think it will be admitted by all who believe in the gradual modification of organic beings, that, irrespective of any knowledge as to the subsistence of diverse functional correlations between the sexual elements of the individual flowers, the mere structural differences suffice to show

us the manner by which the at present normally characteristic "subdiœcious hermaphrodism" of the *P. veris*—and, of course, of all the other dimorphic species of Primalus—has been attained, and, furthermore, take us back to that period in its genealogy when non-dimorphism or perfect hermaphrodism was the genital characteristic of its line. Here, as I believe, we are afforded an instance of variability perfectly analogous to, though certainly less remarkable than, the *Catasetum* case, so ably elucidated by Mr. Darwin. And just as *Catasetum* and *Monochanthus* occasionally produce each other and likewise the hermaphrodite *Myanthus*, thus inducing us to regard the former sexual forms as the modified descendants of the latter, so in the case of the non-dimorphic plant of the Cowslip, we see first the original condition in those flowers whose stamens and pistils are of an equal length, and a mutual adaptation subsisting between their male and female sexual elements, and secondly, the earliest indications of a divergence from that condition and a tendency to the dimorphic in those flowers with stamens and pistils of different lengths.

In the two forms of *Primula Sikkimensis* the stigmas differ little in shape or roughness, but greatly as respects the length of their styles, that of the long-styled being fully four times longer than that of the short-styled form. The stamens in the long-styled form rise little above the ovarium; in the short-styled form they are attached halfway up the corolla-tube; so that the relative differences in the length of these organs in the two forms are much less marked than those of their styles. There are also very marked differences in the pollen-grains of the two forms; those of the long-styled plants are sharply triquetrous, smaller, and more transparent than those of the short-styled, which are of a bluntly triangular shape.

In respect to the relative fertility of the two forms, I may state that when carefully protected from insects they rarely produce a single seed. The long-styled form I have indeed found perfectly sterile when thus protected, while the short-styled form under similar treatment occasionally produces a few seeds. This slightly greater self-productiveness of the latter form is readily explained when we take into consideration the relations of its anthers and stigmas, these being relatively so disposed that it is scarcely possible for the dehiscence of the anthers to take place without a few of the pollen-grains falling upon the stigma. In the long-styled form, on the other hand, where the stigma rises high above the anthers, such a result can only be effected by insects or other

external agencies. When both forms, however, are artificially fertilized with their own pollen, we find that the long-styled unions are much the more fertile, exceeding the short-styled in about the proportion of two to one! This I have indeed found to be the case, in a more or less marked degree, in all the dimorphic species on which I have experimented, with the exception of the *P. Auricula* and the *P. vulgaris alba*, as may be seen by referring to the tables previously given of those plants. Mr. Darwin notices (*loc. cit.* p. 92) this relatively decreased grade of fertility in the short-styled homomorphic unions, and very naturally regards it as a quality specially acquired for the counteraction of the greater facilities presented by this form than the other for self-fertilization. Thus, by an increased differentiation of pollen and stigma with respect to their mutual action, Nature renders the short-styled forms equally dependent with the long-styled forms on external agencies for the production of aught above the lowest grade of fertility. And thus, as Mr. Darwin has forcibly urged, one of the great ends of reciprocal dimorphism is more perfectly effected—the greatest facilities afforded for the intercrossing of individuals.

The following table gives the results of my experiments on the two forms of *Primula Sikkimensis*:—

TABLE VIII.—*Primula Sikkimensis.*

	Number of flowers fertilized.	Number of good capsules produced.	Number of seeds produced.	Average of seeds per capsule.
Long-styled homomorphic union......	24	17	248	14
Long-styled heteromorphic union ...	12	8	285	35
Short-styled homomorphic union ...	14	8	64	8
Short-styled heteromorphic union ...	12	10	419	42
SUMMARY.				
The two homomorphic unions.........	35	25	312	12
The two heteromorphic unions	24	18	704	39

In the two forms of *Primula cortusoides* the pistil is about three times as long in the one as in the other, the anthers being situated about the middle of the corolla-tube in the long-styled form, and surrounding its mouth in the short-styled form. The longitudinal axis of the long-styled stigmas is double that of the short-styled stigmas, and the stigmatic papillæ of the former are about three times longer than those of the latter. Again, the

pollen-grains of the short-styled plants are larger, less transparent, and more bluntly triangular than those from the long-styled plants.

In the following table I have given the results of my experiments on this species:—

TABLE IX.—*Primula cortusoides.*

	Number of flowers fertilized.	Number of good capsules produced.	Number of seeds produced.	Average of seeds per capsule.
Long-styled homomorphic union......	10	7	287	41
Long-styled heteromorphic union ...	8	6	343	51
Short-styled homomorphic union ...	10	6	228	38
Short-styled heteromorphic union ...	8	8	487	61
SUMMARY.				
The two homomorphic unions.........	20	13	515	39
The two heteromorphic unions	16	14	830	59

I tried repeatedly to reciprocally hybridize the two forms of *P. cortusoides* with those of *P. Sinensis*, but though I was led to anticipate favourable results from the swelling of several of the capsules, I was ultimately disappointed, as they did not contain a *single good seed*. I was more successful, however, in a similar series of experiments with the *P. cortusoides* and *P. mollis*; the latter, as I have previously stated, is characterized by an equality in the length of the stamens and styles. The results are given in the table beneath. If we compare the results with the pure unions of *P. cortusoides* in Table IX., and with those of *P. mollis*, we shall see that the fertility of both species is greatly decreased; we shall also see that there is still no regularity as to the degree of fertility resulting from the converse unions. Thus, the pure *long-styled homomorphic unions* of *P. cortusoides* yield an average of forty-one seeds per capsule, while by its union with *P. mollis* —the latter being used as male—the average is reduced to five seeds per capsule—that is, as eight to one. The short-styled *P. cortusoides* by pollen of *P. mollis* did not *yield a single seed*, though several of the capsules swelled. Higher grades of fertility are seen to result from *P. mollis* as female. Thus, by pollen of the long-styled *P. cortusoides* it yields an average of fifty-one seeds per capsule; by pollen of the short-styled *P. cortusoides* the results are sixty-seven seeds per capsule. Now, from the pure unions of

P. mollis the average of seeds per capsule is 165. So that the decreased fertility of the cross-unions relatively to the pure unions of the latter is in the former case as 1 to 3·23, in the latter as 1 to 2·46. Respecting the irregular fertilities of the converse unions we will simply refer to the fact, by way of further supporting our previous remarks on this point, that though the short-styled *P. cortusoides* when used as female with the *P. mollis* is utterly sterile, yet by the converse union of these the highest grade of fertility, relatively to any of the other unions given in the table, is produced. I may also, in passing, notice that the seeds produced upon the long-styled form of *P. cortusoides* were very fine, though the average per capsule is low. Those, on the other hand, produced by *P. mollis*, in its different unions with the long- and short-styled forms of *P. cortusoides*, were so very small, that I entertain little hopes of any of them germinating.

In the following table we have the results of these unions of *P. cortusoides* with *P. mollis*.

TABLE X.—Hybrid unions of *P. cortusoides* with *P. mollis*.

	Number of flowers fertilized.	Total number of capsules produced.	Number of good capsules.	Number of seeds produced.	Average of seeds per capsule.
Long-styled *P. cortusoides* by pollen of *P. mollis* ...	12	7	5	27	5
Short-styled *P. cortusoides* by pollen of *P. mollis* ...	12	5	0	0	0
P. mollis by pollen of long-styled *P. cortusoides*	10	6	4	205	51
P. mollis by pollen of short-styled *P. cortusoides*	10	8	5	336	67

In the two forms of *Primula involucrata* the pistil is about three times longer in the one form than in the other. The stigma of the long-styled form reaches the mouth of the corolla-tube, and the anthers are situated halfway down the tube: in the short-styled form the converse of this takes place, namely, the style is half the length of the corolla-tube, the anthers reaching its mouth. The stigma of the long-styled form is of a globular shape, and closely beset with long papillæ; that of the short-styled form is smooth and depressed on the apex: the pollen-grains of the latter are also larger and less transparent than those

of the other form; in both, however, they are of a similar (spherical) shape.

Amongst many failures in my experiments on effecting unions between the *P. involucrata* and other species, I succeeded in getting a few capsules containing good seeds by application of the pollen of the short-styled form of *P. Sibirica* to the long-styled *P. involucrata*; I had also successful results by applying the pollen of the short-styled form of *P. farinosa* to the short-styled *P. involucrata.* I have utterly failed, however, to effect unions by the converse experiments of the above, *i. e.* by applying pollen of the two forms of *P. involucrata* to those of the *P. Sibirica* and the *P. farinosa.* The results of the successful unions were as follows:—1. From the long-styled *heteromorphic unions* of *P. involucrata* by pollen of *P. Sibirica* I got four capsules, which yielded an average of ten seeds each. 2. From the short-styled *homomorphic unions* of *P. involucrata* by pollen of *P. farinosa* I had three capsules, and, in all, seventeen seeds; so that the average in this case is reduced to about six seeds per capsule. If we compare these results with those given in the summary of the united homomorphic unions of *P. involucrata* in the following table, we see that these unions yield more seed, in about the proportion of *three to one*, than those from the heteromorphic union of *P. involucrata* with *P. Sibirica*, and as *five to one* relatively to its homomorphic unions with *P. farinosa.*

TABLE XI.—*Primula involucrata.*

	Number of flowers fertilized.	Number of good capsules produced.	Number of seeds produced.	Average of seeds per capsule.
Long-styled homomorphic union......	10	6	230	38
Long-styled heteromorphic union ...	6	4	263	66
Short-styled homomorphic union......	14	7	195	28
Short-styled heteromorphic union ...	6	5	347	69
SUMMARY.				
The two homomorphic unions.........	24	13	425	32
The two heteromorphic unions	12	9	610	68

In the *Primula farinosa* the pistil of the long-styled form is about twice as long as that of the short-styled form, and elevates the stigma slightly above the mouth of the corolla-tube, while the anthers are attached halfway down the latter. In the short-

styled form there is a converse arrangement of these organs observed, the stamens corresponding, or nearly, in length with the pistils of the long-styled form, and the pistils with the stamens of the latter form. The stigmas of the two forms differ little in shape or size, but that of the short-styled form is evidently rougher. The pollen-grains are also of a similar (bluntly triangular) shape in both forms, those of the short-styled being the larger. Besides these two forms, however, characterized as we have seen by a relative inequality in the length of the stamens and pistils, it is not at all uncommon to find individual plants with these organs of an equal length, and reaching the mouth of the corolla-tube. From an examination of specimens, however, from various localities, I have no doubt, from the relatively small size of the pollen-grains as compared with those of the normal long-styled form, that these relations are due to an abnormal development of the stamens. This view is furthermore supported by the functional performances of these organs, as I find, from a few experiments on an equal-stamened and -styled plant in the Botanic Gardens of Edinburgh, that less seed results from its union with the long-styled than with those of the short-styled. The non-dimorphic form of *P. Auricula* (*vide* Table II.) affords an analogous illustration in so far as concerns its functional relations with the long- and short-styled forms of the species. But there is one important difference between the two cases, namely, that the non-dimorphic form of *P. Auricula* is perfectly fertile with own-pollen, whereas the like form of *P. farinosa* is very imperfectly fertile when thus treated! indeed much less so than either homomorphic union. This is seen by referring to the table beneath, where we find that the united homomorphic unions yield more seed, in about the proportion of *two to one*, than those of the equal-stamened and -styled form by own pollen.

In the following table I have given, first, the unions with the equal-stamened and -styled form by own pollen, and secondly, the reciprocal unions of the long- and short-styled forms.

TABLE XII.—*Primula farinosa.*

	Number of flowers fertilized.	Number of good capsules produced.	Number of seeds produced.	Average of seeds per capsule.
Form with stamens and pistils of an equal length by own pollen	12	5	62	12
Long-styled homomorphic union......	14	7	210	30
Long-styled heteromorphic union ...	8	5	264	52
Short-styled homomorphic union ...	14	8	150	19
Short-styled heteromorphic union ...	8	7	380	56
SUMMARY.				
The two homomorphic unions.........	28	15	360	24
The two heteromorphic unions	16	12	644	54

To the above notice of the pure unions of *P. farinosa* I will now add the results of my experiments on the fertilizing it with the pollen of other species; these were chiefly confined to the *P. Scotica*, *Sibirica*, and *involucrata.* In my previous notice of the latter species, I have shown that the short-styled form of *P. farinosa* is capable of fertilizing the short-styled form of *P. involucrata*, and I also stated that I had utterly failed in effecting the converse union of these forms. The latter failures are included in the following experiments on four fine umbels of the long-styled and three of the short-styled form of *P. farinosa.* I carefully fertilized sixty flowers, one half with the long-styled and the other with the short-styled form of *P. involucrata*, yet, though several capsules swelled, they did not contain a single good seed! I also tried reciprocal unions between the two forms of *P. farinosa* and the long-styled form of *P. Sibirica*, but these unions, like the preceding, resulted in the complete abortion of every seed. With *P. farinosa* by pollen of *P. Scotica* I have had a little more success: thus, from twelve flowers of short-styled *P. farinosa* fertilized by pollen of *P. Scotica* I got seven capsules; three of these contained no good seed; the other four yielded in all 91 seeds, which gives an average of nearly 23 seeds per capsule. Now if we refer to the above table of the different unions of *P. farinosa*, we shall see that the fertility of the united homomorphic unions is 24 seeds per capsule, so that these pure unions only exceed the above hybrid unions of the species in the proportion of 100 to 95; *i. e.*, for every hundred seeds yielded by the pure homomorphic unions of *P. farinosa*, 95 are yielded by

its hybrid unions with *P. Scotica.* From these results of the *short-styled hybrid* unions, I naturally anticipated, from the evident structural affinities of the two species, somewhat similar results from the *long-styled* unions. In this, however, I was completely wrong; for, after a number of careful experiments, I have failed to get a single seed from the *long-styled P. farinosa* by pollen of *P. Scotica.* How clearly do such cases show us that sterility does not strictly follow systematic affinity. On the other hand, how forcibly do they urge, as Mr. Darwin has well remarked on certain analogous cases, "that the capacity of two species to cross is often connected with constitutional differences imperceptible by us, and confined to the reproductive system."*

We have seen that *dimorphism,* as applied to the structure of the reproductive organs, is a very general, though not, as has been asserted, a universal characteristic of the genus *Primula,* but that several of the species presenting structurally no such relations have, on the other hand, their stamens and pistils of an equal length. Seeing then that the dimorphic structure, in the case of the Primulas, is so invariably correlated with distinctive physiological characteristics, we are naturally led to consider the nature of the reproductive powers of those species which are structurally non-dimorphic, *i. e.* those which have stamens and pistils of an equal length, and see whether or not these structural dissimilarities are connected with any alteration in the functional characteristics of the species. With the view then of illustrating the latter point, I will give the results of a few experiments on three of the latter (non-dimorphic) species.

1. *Primula Scotica.*—The length of the stamens and pistils of this non-dimorphic species varies slightly, as I have already stated, under cultivation: there being a regular correlation, however, observed, in this variation of the sexual organs, the non-dimorphic structure remains unaffected,—the *stigma,* in every case which has come under my observation, being *closely appressed* by the surrounding *anthers.* From this intimate relation of anthers and stigmas, we are naturally inclined to suppose that, after the dehiscence of the anthers, the stigmas will be liberally supplied with pollen. This is not strictly true; the cohesive nature of the pollen-grains still retains them within the open lobes, so that if the flowers be carefully guarded from external disturbance, the *apices* of the stigmas, even in their last stages of decay, are generally found destitute of pollen-grains.

* 'Origin of Species,' 3rd edit., p. 280.

Even under these conditions, however, an imperfect fertility is induced; as by the dehiscence of the anthers, which closely surround the stigmas, the pollen-grains are brought into immediate contact with the exterior or circumference of the stigma, into which they protrude their tubes, and thus induce a variable though usually a low grade of fertility. This will be seen by an examination of the table beneath, which gives the results from four plants of the *P. Scotica* under the following treatment:—Two of the plants were placed under a shaded bell-glass, and had their flowers artificially fertilized; a third was placed under similar conditions, so as to guard against the aid of all external agencies in the fertilization of the flowers—each of the latter in this case being left to its own innate means; in the fourth, and last, the plant was freely exposed, so as to favour, as far as possible, the action of insects or other agents employed in the fertilization of the flowers.

In Table XIII. the results of the protected and artificially fertilized plants are given in distinct lines, as one of them was very weak and produced two poor umbels, the products of which, united with the other, would give a very unfair idea of the normal average of seeds produced by these plants under the above treatment. If we compare the results, then, of the artificially fertilized flowers in the second line alone with those in the first line, carefully protected from all external fertilizing agencies, we see that the latter, though equally as productive of capsules as the former, nevertheless falls far below it in the *average* of *seeds* per capsule, the proportion in favour of the former being as 2·24 to 1. Again, if we compare the results of the protected and unartificially fertilized flowers with those from the unprotected flowers, given in the fourth line, we see that the latter also exceeds the former in the average of seeds per capsule, in the proportion of 1·87 to 1. Lastly, by comparing the results of the artificially fertilized flowers, in the first line of the table, with those of the unprotected flowers, in the fourth line, we see that the average fertility of the former relatively to the latter is as 1·11 to 1.

We thus see that the *Primula Scotica is* capable of self-fertilization; but, from its extremely imperfect nature, we are rather inclined to regard it as a mere provision against absolute sterility, than to suppose that the plant is habitually dependent on such manifestly imperfect means for its fertilization; that, in fact, in this species, as in the truly dimorphic, fertilization is largely aided by insect or other mechanical agencies; so that, as one of

the grand ends of sexual dimorphism is the crossing of distinct individuals, we have, in this imperfect self-fertility, indications of a desire in nature to facilitate similar conjunctions in this non-dimorphic species. As it might be supposed, however, that this imperfect self-fertility was due to a differentiation of a flower's own pollen to its own stigma, I may expressly state that the complete fertility of the artificially fertilized flowers was the result of fertilization in every instance by the flower's own pollen. There can be no doubt, therefore, that the imperfect fertility of the unartificially fertilized flowers was simply owing to the stigmas being insufficiently supplied with pollen. As further supporting this, I may also state, that in my tables where the amount of seeds produced by each capsule is stated separately, much less variation in the amount is presented by those artificially than those naturally fertilized.

Table XIII.—*Primula Scotica.*

	Number of flowers.	Number of flowers fertilized.	Number of capsules produced.	Number of seeds produced.	Average of seeds per capsule.
Flowers carefully protected from all external fertilizing agencies	10	...	6	568	95
Flowers protected from insects, and artificially fertilized	...	6	4	852	213
Flowers protected from insects, and artificially fertilized	...	14	9	1249	139
Flowers unprotected, and freely exposed to insect and other agencies	...	13	8	1426	178

2. *Primula mollis.*—The relations of anthers and stigmas in this species, as in the preceding, are highly favourable to self-fertilization, the latter organs being closely surrounded by the former, and included within the tube of the corolla. In respect to its regular self-fertility, it greatly exceeds all the other species with which I have any acquaintance, inasmuch as nearly every flower produces a capsule *filled* with *good seed*; whereas in the other non-dimorphic species which have come under my observation there is very generally a high percentage of abortive capsules, together with a great variability in the number of seeds contained in those that do set. Though I had never seen the flowers of

this species (*P. mollis*) frequented by insects, I carefully protected a few plants, in case this regularly complete fertility might be due in part to such agencies. The seed-produce, however, from these plants was in no way affected; the average of capsules, and of seed per capsule, was quite equal to those from the unprotected plants. The following are the results from a single scape of a protected plant, which I believe affords a fair idea of the average fertility of this species in a cultivated state:—

	Number of verticils.	Number of flowers.	Total number of capsules.	Number of good capsules.	Number of seeds.	Average of seeds per capsule.
Primula mollis	4	17	17	14	2306	165

3. We have thus seen, then, that the Primulas *Scotica* and *mollis*, in *function* as in *structure*, are alike *non-dimorphic*. This, however, does not appear to be the case with the following species, *P. verticillata*, which apparently presents an *imperfect functional dimorphism* in conjunction with a non-dimorphic structure! As I have already stated, the anthers in this species are attached to the upper third of the corolla-tube, and in general closely surround the stigma; occasionally, however, the latter rises above the anthers, and even becomes slightly exserted beyond the corolla-tube. In such relations, then, of anthers and stigma as occur in the latter case, it is at once evident that sterility may be simply due to the pollen not reaching the stigma. Anyhow, the existence of plants producing flowers of the latter description renders all but valueless the few observations I had made on the self-sterility of this species under cultivation, previous to the publication of Mr. Darwin's paper on Primula-dimorphism, inasmuch as I was then utterly ignorant of such singular sexual relations, and therefore paid no regard to the relative lengths of the stamens and pistils of those plants which came under my observation. In respect to these I will therefore simply state that for two successive seasons I failed to get a single seed from a fine healthy plant of this species, though each season it produced a profusion of flowers. I have also received a nearly similar testimony from the observations of others, namely, that they rarely ever succeeded in getting seed from *solitary plants* of this species, though they have frequently gathered it when a few plants were growing together. But for the existence,

then, of the form with the stigma rising above the anthers, which I only observed in a *cultivated* state this season, such testimony would have rendered highly probable the view I have taken as to the existence of a functional dimorphism in this species; and this the more especially on taking into consideration the results of the few experiments I have lately had an opportunity of making. It is, indeed, only from the accordance of the latter with my previous observations that I have ventured to refer sterility in this case to a dimorphism in function; and I think I am fully justified in so doing; for how, I ask, can an explanation otherwise be afforded for the low fertility of the hermaphrodite conjunctions and the high fertility of the diœcious conjunctions? That such phenomena are presented by the individuals of this species I will now show by the following details of my experiments.

In the summer of 1862 I examined every flower upon a fine scape of *P. verticillata*, and observed a very general equality in the length of the stamens and pistils. On a subsequent examination I observed more or less pollen on the stigmas of seventeen out of the twenty-three flowers borne upon the scape. The remaining six I therefore artificially fertilized with own pollen. The results, however, were in no respect different from those previously alluded to; a high percentage of the capsules were utterly abortive, and the few which did swell contained *no good seed.*

The results of my experiments this summer (1863) have somewhat modified those of 1862, inasmuch as certain of the flowers fertilized by own pollen have yielded a considerable amount of seed; this will be seen by consulting the following table:—

TABLE XIV.—*Primula verticillata.*

	Number of flowers fertilized.	Total number of capsules produced.	Number of good capsules.	Number of seeds produced.	Average per capsule.
Flowers fertilized by own pollen	18	8	3	769	256
Flowers fertilized by pollen from a distinct plant ...	8	5	5	1245	249
Flowers fertilized by pollen from a distinct plant ...	10	8	7	1957	279
SUMMARY.					
Flowers fertilized by own pollen	18	8	3	769	256
Flowers fertilized by pollen from a distinct plant ...	18	13	12	3202	267

In the first line of the above table I have given the results from a single scape, each flower of which was artificially fertilized by own pollen; in the second and third lines we have the results of the reciprocal crossings of flowers on distinct individuals; and lastly, for the sake of comparison, I have simply restated the results of the unions with own pollen, and given the united results of the reciprocal unions. If we compare the average of seeds per capsule, we see that the unions with own pollen give an average of four seeds per capsule over those in the second line of the table—fertilized by pollen from a distinct individual; the scape, however, which yielded the latter was very weak, so that it affords a very unfair estimate of the normal fertility of the species under the above treatment. A more just idea of the relative fertility of flowers fertilized by own pollen and those fertilized by that from a distinct individual may be formed by comparing the results of the first and third line of the table, these being the results of two equally healthy scapes. Now, in this case we see that those flowers fertilized by pollen from a distinct individual give an average of twenty-six seeds per capsule over those fertilized by own pollen. The most important fact, however, shown in the above table is the increase in the number of good capsules produced by those flowers fertilized by other's pollen as compared with those fertilized by own pollen. Thus, from eighteen flowers of the latter, treated by own pollen, eight capsules set, but of these only *three* contained good seeds; whereas from the same number of flowers of the former, treated by other's pollen, thirteen capsules set, twelve of which were well filled with good seeds: so that the treating with other's pollen exceeds that by own pollen in the proportion of *four* to *one*!

He who will carefully study these observations and experiments on *P. verticillata* will see those conditional peculiarities of the generative system which I have ascribed to a functional dimorphic quality. He will also see, however, by comparing the results of experiments in 1862 with those of 1863, that the individual and reciprocal—*i. e.* hermaphrodite and diœcious—functional relations of the male and female organs are much too capricious to permit of their assignment to any definite law; they are yet, as it were, mere tracings, or, rather, indications of a tendency to become functionally dimorphic. Apart from the evidence afforded by the low percentage of good capsules produced from fertilization by own pollen relatively to that from the reciprocal fertilization of distinct individuals, this, I think, is

clearly shown by the relatively increased percentage of seeds resulting from the latter conjunctions. This relative increase in the percentage of seeds by the reciprocal unions, though certainly much under those usually resulting from a comparison of the homomorphic and heteromorphic unions of Primulas, is nevertheless sufficient to affect importantly the number of the individual representatives; and this the more especially if, as Mr. Darwin forcibly urges, close-breeding has a tendency to weaken the progeny.

Connected with these functional peculiarities there is another point worthy of a passing notice—namely, the variability in the length of the pistil. As I have previously stated, this organ is generally of an equal length with the stamens; occasionally, however, flowers occur in which the stigmas rise above the stamens and project beyond the mouth of the corolla-tube; and again there are others in which it does not even reach the stamens, while the latter in every case observed by me retain a definite position around the mouth of the corolla-tube. The intimate systematic affinities, already alluded to, of the present species with the *P. floribunda* give the above variabilities an additional interest. In respect to the latter species we have stated that along with normally short-styled plants, others occur in which the stamens and pistils are of an equal length. Guided by analogy, then, we may suppose that as the *P. floribunda* has not as yet attained the, at least provisional, equilibrium of dimorphism, as shown by a percentage of non-dimorphic forms, so these functional and structural peculiarities of the *P. verticillata* are presumptive indications of an ulterior dimorphic tendency.

Summary.—The species of *Primula* are variously estimated by authors, many of the forms reputed specific by one being considered as mere varieties by another. Steudel, for example, in his 'Enumeratio Plantarum,' admits 85 species, whereas DeCandolle ('Prodromus') gives only 61—a difference of 24 doubtful forms. Of these varieties or species, then, I have given the sexual characteristics of 54:—36 of which are truly dimorphic, presenting both long- and short-styled forms; 13 in which the long- or short-styled forms, respectively, have alone been observed by me; and 5 species and one variety with non-dimorphic characteristics, *i.e.* presenting stamens and pistils of an equal length.

The allied genera *Hottonia* and *Aretia* have also truly dimorphic species; whereas other allied genera—*Dodecatheon*, *Soldanella*, and

Cortusa—are very generally characterized by species presenting the structural characteristics of the long-styled form only, without, however, any decreased fertility arising from their hermaphrodite conjunctions.

The general differences of the two sexual forms may be thus briefly summed up:—First, the long-styled forms have pistils equalling in length the tube of the corolla; stigmas usually larger and rougher; stamens attached to, or frequently below the middle of the corolla-tube, whose diameter is thus expanded upwards; pollen-grains generally smaller and more transparent. Secondly, in the short-styled form the pistil is short, not rising above halfway up the corolla-tube; stigma generally smoother and depressed on the summit; stamens attached to the mouth of the corolla-tube, causing an abrupt expansion; pollen-grains generally larger and more opaque. According to all the trials, these structural differences are accompanied by equally remarkable functional differences, —the pollen of the long stamens being alone adapted to fertilize the long pistils, and the pollen of the short stamens to fertilize the short pistils. By applying, on the other hand, either form pollen to own form stigma, *i. e.* effecting a homomorphic union, the degree of fertility relatively to the above, or heteromorphic union, is greatly decreased. Analogous, though less striking, functional differences, however, occur without any appreciable change of structure, as shown by the *P. verticillata, e. g.*, yielding a much higher grade of fertility by its diœcious than its hermaphrodite conjunctions. Such an instance from a genus whose members are so generally characterized by a sexual dimorphism, naturally leads me to regard it as indicative of the acquirement of similar characteristics. An objection to this view may be urged from the occurrence of species which, having no immediate affinity with any structurally dimorphic species, nevertheless present individuals incapable of fertilization by own pollen, though perfectly susceptible to reciprocal fertilization, either with another individual of the same species, or one of a distinct species. To this category, at least, those who disbelieve in the genetic affinities of organic beings will no doubt refer the case of *P. verticillata*, and simply regard it as further illustrative of our ignorance of the conditions upon which sterility, in its varied grades, depends. Those, on the other hand, who believe in the existence of these genetic relations will look with an intelligent interest upon these functional peculiarities of the *P. verticillata*, and regard them, mayhap, as the primary indications of a tendency to assume those

remarkable sexual characteristics of the correlated species, and thus presenting an illustration of incipient dimorphism.

The usual differences in the fertility of the heteromorphic and homomorphic unions will be best appreciated by giving the mean results from the unions of several species. Thus, taking the five heteromorphic and homomorphic unions given above, namely, *P. Auricula*, *Sikkimensis*, *cortusoides*, *involucrata*, and *farinosa*, we see, from the mean results of their combined products, that for every 100 seeds yielded by the heteromorphic unions, only twenty-four are yielded by the homomorphic unions,—the heteromorphic thus exceeding the homomorphic unions in about the proportion of five to three! I have also shown the remarkable fact that the pollen of a distinct species will produce a much higher grade of fertility than an ordinary homomorphic union, *i. e.* a flower's own pollen!

It is well known that A will fertilize B, and B will not fertilize A. I have given instances of this law with Primulas. I have also shown the new and remarkable fact, that of the two forms of the same species the pollen of the one, but not of the other, will fertilize a distinct species! For example, the long-styled *P. Pallinurii* can be fertilized readily by pollen of the long-styled *P. Auricula*; yet, after numerous trials, I have failed to effect a single union between the long-styled form of the *P. Pallinurii* and the short-styled *P. Auricula*. How utterly inconsistent, then, are such facts with the teachings of those who would have us believe that an absolute causal relation exists between the sterility from hybridism and systematic affinity! On the other hand, how unequivocally do these cases show us that the greater or less facility of one species to unite with another is, as Mr. Darwin has sagaciously argued, "incidental on inappreciable differences in their reproductive systems. And that there is no more reason to think that species have been specially endowed with various degrees of sterility to prevent them crossing and blending in nature, than to think that trees have been specially endowed with various and somewhat analogous degrees of difficulty in being grafted together in order to prevent them becoming inarched in our forests."*

Probably the most remarkable result from my observations is that when the dimorphic species cease to be dimorphic, their reproductive functions are greatly modified. Thus, in the case of the Cowslip, for example, we have seen that an ordinary homomorphic union yields about fourteen seeds per capsule, the hetero-

* 'Origin of Species,' 3rd edit. p. 299.

morphic about twenty-four seeds per capsule, whereas the form with stamens and pistils of an equal length yields, when fertilized with its own pollen, thirty-four seeds per capsule! Thus the non-dimorphic form by own pollen exceeds, first, the homomorphic unions in the proportion of 5 to 2, and secondly, the heteromorphic in the proportion of 3 to 2! Again, from the four different unions of the long- and short-styled forms with the non-dimorphic form, the seed-results in each case fall considerably below an ordinary homomorphic union: thus the mean results of the unions of the non-dimorphic with long- and short-styled are six seeds per capsule, whereas the pure homomorphic unions of the latter give an average of thirteen seeds per capsule—that is, as two to one!

Connected with these are the remarkable changes in the fertility of the coloured varieties of the Primrose, the red variety yielding no seed when fertilized by pollen of either yellow or white varieties: the reciprocal crosses of these, *i. e.* the pollen of the red variety applied to the stigmas of the yellow and white, are also absolutely sterile! On the other hand, fertile unions may be effected by the reciprocal crossing of the yellow and white varieties, though in every case we have found that the average seed-result of such unions is considerably under that of the pure unions of these forms.

Whether or not the ultimate tendency of dimorphism is a complete separation of the sexes, I think we have the clearest testimony that dimorphism has not always been a genealogical characteristic; and furthermore, that the two forms did not *per saltum* assume these structural and physiological characteristics. I here allude to the evidence afforded by the non-dimorphic Cowslip—namely, the resumption of perfect hermaphrodism, and the occasional production of intermediate stages between this and the normally dimorphic. These, taking us back in the genealogical line, show us an original non-dimorphic progenitor, and the graduated plan by which it gave rise to a dimorphically characterized race.

A few Notes on the Fecundation of Orchids and their Morphology.

By Dr. H. Crüger, Director of the Botanical Garden, Trinidad. Communicated by Charles Darwin, Esq., F.R.S.

[Read March 3, 1864.]

[Plate IX.]

Whoever has read C. Darwin's remarkable work on the fecundation of Orchids must have regretted that the chapters on tropical and other foreign Orchids leave a certain amount of uncertainty on the mind of the reader until the observations and suppositions shall have been endorsed by actual facts observed in the native countries of these plants. To fill up, as far as lies in my power, this blank is the purpose of the following observations and notes, to which I have added some remarks which I hope will not be deemed out of place.

Of the larger-flowered *Catasetideæ* we have here in Trinidad three genera (defining the section somewhat differently from Dr. Lindley). These are *Catasetum*, *Coryanthes*, and *Stanhopea*. Of the first we have one species, *C. tridentatum*, very common, and in various varieties, of which some authors have thought proper to make species. It shows in this island both the extreme forms, which I do not hesitate to call male and female; very frequently intermediate forms may be seen. I may state at once that these latter are always sterile. The two principal forms have been described so often, and latterly so well by Darwin, that I may restrict myself to a very few words, bearing principally on the essential parts for fecundation.

The anther and pollen of the male flower are principally distinguished by size and quantity from the corresponding parts in the female flower; the microscopic character of the pollen-tetrades is the same in both. We shall see further on that it is not so with their physiological action. The anther of the female flower drops off immediately after the opening of the same, *i. e.* before the flower has reached perfection as regards colour, size, and smell. The disk (of Darwin; caudicle of other authors) does not cohere, or very slightly, to the pollen-masses, but drops off about the same time, with the anther. In the male flower, where the pollen-masses, &c., are in a much more considerable state of development, the deficiency is in the conducting tissue (*tela conductrix*), which is the true stigma of this and allied plants as far as function is concerned. While in the male flower there is only a thin layer of this tissue lining the stigmatic canal, it is very abundant in the

female flower, mixed with a large quantity of sweetish mucosity. This secretion, while it probably causes the disaggregation of the cells of the conducting tissue, has the property of separating the pollen-cells when these latter are brought into contact with it. I could not, however, discover any difference in this respect between the pollinia of male and female flowers, for both were acted on in the same way; but there the resemblance ceases. Left a little longer in contact with this mucosity, the pollen-cells of the male push forth a vigorous vegetation of pollen-tubes, while from the pollen of the female only here and there a rudimentary tube may be seen.

I would here remark, that this action of the sweet mucosity on the cohering tissues of the pollen appears to me to belong to the phenomena of fermentation, in its wider sense. The same effect is produced by substances in a state of decomposition, and may be compared in some manner to the ripening of fruit. It must not, however, be confounded with the action of boiling on certain tissues of roots, where it is explained, according to recent researches, by the conversion of the outer layers of cells into pectose, which is rendered soft by boiling in water.

Although I have tried, like others before me, repeatedly to impregnate a male flower with its own pollen, I have always failed. The incomplete development of the conducting tissue explains this sufficiently. On the other hand, the operation never fails with the female flower when male pollen-masses are applied to it at the proper moment. The action of female pollen is at first not to be distinguished from that of male pollen, but until now I have not seen a case of complete success. The ovarium enlarges, the labellum &c. fade, pollen-tubes are emitted; but after a week or so the ovarium begins to fade, turns yellow, and finally drops, without bringing any seeds to perfection, or even without fecundation taking place.

Many years ago, when specially occupied with the more intimate phenomena of fecundation in plants, I pointed out (Bot. Zeitung, 1851) that pollen, besides giving the material founpation (*sit venia verbo*) for the pollen-tubes, has an evident power of stimulating a flower to development—to the production of ovules or their perfection. Dr. Hildebrand has lately (Bot. Zeitung, 1863, Nos. 44 & 45) published detailed observations on this subject, without however stating anything not previously known. Does not the female pollen of *Catacetum* possess only one-half of the functions of the male pollen? In answering this

question it should not be forgotten that both powers, although they admit of being considered separately, may be only consequences of the same physiological quality.

From the above it is made evident that the fecundation of the female flower must take place by means of the pollen of the male flower, as in other plants with distinct sexes. As fruit on this plant is extremely common, it is impossible to attribute it to any other agency than that of insects. And here I have had occasion to verify the supposition of Darwin to its fullest extent.

The female flower opens when still comparatively young, as already mentioned. The male flower emits a peculiar smell about twenty-four hours after opening, and the antennæ assume their greatest irritability at the same time. A large humble-bee, noisy and quarrelsome, is now attracted to the flowers by the smell, and a great number of them may be seen every morning for a few hours disputing with each other for a place in the interior of the labellum, for the purpose of gnawing off the cellular tissue on the side opposite to the column, so that they turn their backs to the latter. As soon as they touch the upper antenna of the male flower, the pollen-mass, with its disk and gland, is fixed on their back, and they are often seen flying about with this peculiar-looking ornament on them. I have never seen it attached except to the very middle of the thorax. When the bee walks about, the pollen-mass lies flat on the back and wings; but when the insect enters a female flower, always with the labellum turned upwards, the pollinium, which is hinged to the gland by elastic tissue, falls back by its own weight and rests on the anterior face of the column. When the insect returns backwards from the flower, the pollinia are caught by the upper margin of the stigmatic cavity, which projects a little beyond the face of the column; and if the gland be then detached from the back of the insect, or the tissues which connect the pollinia with the caudicle, or this with the gland, break, fecundation takes place. I have been an eye-witness only of the first event; I conceive, however, the possibility of the other.

I have tried to represent the above by a sketch (Pl. IX. figs. 1, 2, 3). That the insects are attracted at first by the smell of the flower I take from the fact that the same insect visits *Coryanthes macrantha*, *Stanhopea grandiflora*, and *Gloxinia maculata*, all three of which have the same perfume. But the smell probably only gives notice to the insects; the substance they really come for, in the case of these Orchids, is the interior lining of the labellum,

which they gnaw off with great industry, and for which there is a continual contest. The same substance is also very attractive to other insects, such as cockroaches, &c.

This same substance, *i. e.* some cellular tissue which these humble-bees gnaw off, exists also in the hypochil of *Coryanthes macrantha*. They are seen in great numbers disputing with each other for a place on the edge of the hypochil. Partly by this contest, partly perhaps intoxicated by the matter they are indulging in, they tumble down into the "bucket," half-full of a fluid secreted by organs situated at the base of the column. They then crawl along in the water towards the anterior side of the bucket, where there is a passage for them between the opening of this and the column. If one is early on the look-out, as these Hymenopters are early risers, one can see in every flower how fecundation is performed. The humble-bee, in forcing its way out of its involuntary bath, has to exert itself considerably, as the mouth of the epichil and the face of the column fit together exactly, and are very stiff and elastic. The first bee, then, which is immersed will have the gland of the pollen-mass glued to its back. The insect then generally gets through the passage, and comes out with this peculiar appendage, to return nearly immediately to its feast, when it is generally precipitated a second time into the bucket, passing out through the same opening, and so inserting the pollen-masses into the stigma while it forces its way out, and thereby impregnating either the same or some other flower. I have often seen this; and sometimes there are so many of these humble-bees assembled that there is a continual procession of them through the passage specified.

I have not seen the fecundation of *Stanhopea*; it is visited by the same insect, and I have caught it with the pollen-mass of the plant on its back, but I do not see how it can insert the same into the stigma. The insect visits this flower again for the purpose of gnawing off some substance from the labellum; but the same is so far removed from the stigma, that it could hardly, in the fully-opened flower, perform the act of impregnation except in very rare cases and accidentally. I may say that *Stanhopea grandiflora* very rarely bears seeds.

The disposition of *Stanhopea*, and partly of *Catasetum*, where there is no stigmatic liquid substance secreted at the exterior of the column, and where consequently the pollinia have to be inserted into the stigmatic transverse cleft, is repeated in *Gongora maculata*, L. (figs. 4, 5, 6, magnified). This plant often bears fruit.

It is visited, exclusively during the day, as far as I can see, by a splendid bee, probably a *Euglossa*, but with the tongue nearly twice as long as the body. The tongue passes out behind the abdomen, and is there curved upwards. As these also only come for biting and gnawing the anterior side of the labellum, the protruding tongue touches or approaches the gland at every retrograde movement of the insect. By this it can hardly fail to be loaded sooner or later with the pollen-masses, which are then easily inserted into the stigmatic cleft. I have, however, not as yet observed this fact.

While in *Catasetum* one flower is always impregnated by pollen of another, the possibility of self-impregnation exists in the other three examples, and I have no doubt that it often happens. In *Epidendreæ* I have also noticed it many times; and I believe it is owing, in the latter cases, to the abundance of stigmatic viscosity on the face of the stigma, which is situated, in nearly all plants of this suborder, immediately below the pollen-bed. We have here in Trinidad three plants belonging to *Epidendreæ*—a *Schomburgkia*, a *Cattleya*, and an *Epidendrum*—which rarely open their flowers, and invariably are impregnated when they do not open them. In these cases it is easily seen that the pollen-masses have been acted upon by the stigmatic fluid, and that the pollen-tubes descend from the masses still *in situ* down into the ovarian canal. This has also been shown to be the case in a certain class of dimorphic flowers, as in *Viola* and *Oxalis*, where the pollen emits tubes from the anthers, which tubes enter the stigma and descend to the ovules (see H. v. Mohl, Bot. Zeitung, 1863, Nos. 42 & 43).

But, surrounded as we are by innumerable facts demonstrating that self-impregnation is, contrary to what was formerly supposed, *not* the rule, and *necessary* self-impregnation an extremely rare case, I must entirely demur to the conclusion that these few facts are destructive to the Darwinian theory, or, as Mohl has it, are of equal value to prove a contrary theory. Probabilities deduced from the number of observed facts must always enter for a large part into our theories, in sciences of a complex nature. It is true that a *complete* theory admits of no exceptions; but nobody will, I believe, maintain that the above theory has arrived at that state. A few residual facts will not disturb our admiration for it, and the harmony into which it has brought so many branches of natural history hitherto unconnected. As far as intercrossing, and the gradual variation and transformation arising therefrom especially are concerned, there is no necessity to represent to ourselves

the process as absolutely uniform. It is necessarily continuous; but it may have an undulatory character, and present a series of maxima and minima. The process of self-impregnation, which does not exclude, as far as I can see, slow modification, would indicate a period of minimum of transformation.

I shall conclude this by a few observations on the morphology of the Orchid flower. The generally received opinion is that six stamens are partly contained in the column and partly in the labellum. Endlicher went so far as to propound that part of the style was also sunk in the labellum. I have for many years ('Linnæa,' xxii. 1849, translated by Henfrey in 'Scientific Memoirs,' part ii.) been acquainted with facts which support this idea. Subsequent studies, however, have modified my views on the subject, based principally on the development of the flower.

As long as the labellum of the Orchid flower is considered a complex organ, it separates the family from all those that might be compared with it—it stands quite alone. Besides, its degree of complexity is not fixed, as we have seen that Endlicher considers some of the "natura stylina" as entering into its composition. A most unphilosophic view has been taken of the various excrescences and lobes of the column and labellum, showing how the weeds of fantastic morphology will grow in the absence of guiding principles.

Writers like R. Brown and Darwin, who felt that simple fancies were insufficient in a matter of this importance, have thought that the distribution of the vascular cords in the axis at various heights would, if not decide the question, at least bring it near its solution. The result of their investigation has been favourable to the idea that the column consists of seven, and the labellum of three originally distinct organs.

The production and multiplication of vascular cords and their distribution belongs, however, to quite a different class of phenomena, and has only an indirect relation to what I should call morphologic tendencies or impulses. Like dehiscence, disarticulation, production of pollen, ovules, nectar, &c., it belongs to physiologic activity. Darwin accounts for the one by the genetic relation which exists between different beings and organs: for the other by adaptation, itself again consequent on natural selection, often giving by this happy idea the death-blow to the sterile and unhealthy principle of final causes. To persons who have dissected much, it must be evident that the transition of vascular cords into a given organ depends on their number principally, and

on the relative space which the organ occupies on the axis at the time of its origin, and that their subsequent multiplication is equally dependent on the quantity of tissue which composes the organ in question.

If we look upon the labellum as a simple organ, the family is variously connected with the remainder of the Monocotyledons, and the labellum finds its analogue in various families of both great divisions of the vegetable kingdom (Phanerogams). At the same time the column must contain the nine interior organs of the flower, or, as I would express it, it is here where they partly have not made their appearance.

R. Brown, as is well known, first showed the great importance of organogenetic studies in questions of this kind. He was not led by them in this case, not perhaps admitting that these investigations are always decisive. Others, myself amongst the number, have tried to solve the question in this manner, and finished by owning that the decision was doubtful. Yet, if we consider how many other dark points have been settled by such research, I think the soberest course will always be to try our morphologic speculations on the touchstone of the same, and to accept nothing that has not been ratified by it.

It will be sufficient to describe shortly the development of the Orchid flower to bring out the important points which bear on the question at issue. I shall choose a common plant, *Catasetum tridentatum*. The three sepals appear at the same time, and are followed immediately by the two lateral petals. The labellum makes its appearance only after these, which accounts for its being generally partly covered by them. As the axis grows during this time, the labellum stands a little higher on it than the petals which theoretically belong to the same whorl. Nearly simultaneous with the appearance of the labellum is that of the anther, but the former occupies a larger space on the part of the flower where both are situated.

After this the flower becomes more hollow at the bottom, and the first traces of the ovarian cavity appear. The next organ which becomes visible is the anterior segment of the stigma, as a scarcely perceptible swelling between the upper end of the anther and the ovarian cavity (figs. 7 & 8, *x*). The next change we observe is the appearance of two smaller swellings under the labellum (fig. 11), which, however, soon merge into one (fig. 13), while the anterior lobe takes a rapid development (figs. 9, 10, 12). While in this instance the two posterior lobes of the stigma,

represented by the above little swellings, soon unite, in other plants (*Vanilla* e. g.) they remain divided. This state of things (*i. e.* a part of the stigma standing on the posterior side of the flower) lasts comparatively a long time; it is only late that, by an elongation of the axial part of the flower and a partial reversion, the stigmatic aperture is fixed on one side of the column, and a more or less considerable distance is created between its posterior lobe and the base of the labellum.

This is, I believe, the common mode of development; the bottom of the flower, marked by the undeveloped stigmata, is carried up nearly to the top of the column. In *Cypripedieæ* it is, as far as I can see, rather different, the parts of the stigma being more developed (fig. 16, *Selenipedium palmifolium*, Rchb. fil., column; fig. 17, the same very young) and more distinct from each other, even at a very early period. As this is the only plant of that section which grows wild here, I cannot contrast this with other species*.

The various appendages, excrescences, &c., which are observed on the full-grown column and labellum of so many Orchids are of very late origin, and prove their unessential nature in a morphological point of view, whatever their physiological importance may be.

From the above history of development I draw the following conclusions:—

The eccentric development of the Orchid flower begins with the labellum; and it explains why, when the other perigonial leaves are connected, it remains free, and also the frequent connexion of the same with the column. The successive appearance of the parts of the stigma is another consequence of the above eccentricity.

The part of the axis which bears the stigmata, and the organs immediately surrounding these, of which generally five, sometimes four, do not make their appearance, is afterwards considerably lengthened, and at the same time the eccentric development causes a partial reversal of its apex, and generally the bent or prostrate position of the anther, originally erect.

* This *Selenipedium*, which bears a small, very fragrant vanilla, is in all probability always impregnated by insects. The labellum is, like some Aristolochia-flowers, constructed after the fish-pot system, *i. e.* a funnel-shaped opening conducts into it, and insects find it difficult to escape through the same. The only other opening near the base of the labellum is partly closed by the sexual apparatus, and the insect has to force its way out there.

It is clear that the *Neottieæ*, in the later stages of their development, must have some differences.

As an example of an Orchid where the eccentric development of the flower is reduced to its lowest degree may be quoted *Thelychiton*, Endl. Iconogr. t. 29, where the stigma is central, surrounded by a six-lobed cup, bearing on one of its lobes the anther.

The only example that I am acquainted with of an Orchid flower in which all the stamens make their appearance, or nearly all, is a species of *Isochilus*, found here common enough, and in which this irregularity is very frequent. The flower is normally triandrous, but very often bears five anthers, with a filament proceeding from the front of the column just beneath the stigmatic cavity (fig. 18). If this filament should ever be found to bear an anther, we should have the Orchid flower restored.

On the Double Cocoa-nut of the Seychelles (*Lodoicea Sechellarum*) "Sea Cocoa-nut," "Double Cocoa-nut," "Coco de mer." By Swinburn Ward, Esq., Civil Commissioner. Communicated by Sir W. J. Hooker*, F.R.S. & L.S., &c.

[Read March 3, 1864.]

This extraordinary specimen of the Palm tribe, the largest and most curious of all the many varied kinds scattered over all tropical regions, is found only in two small islands belonging to the Seychelles Group, "Praslin" and "Curieuse," which lie in juxtaposition between 4° and 5° of S. lat., and 55°–56° E. long., —nearly three hundred miles north-east of Madagascar, which, though itself an island, may, from its immense size, be legitimately considered the nearest mainland.

The name by which it is best known, that of "Coco de mer," was given to it by some French navigators who had picked up the nut floating at sea, and being unable to ascertain anything respecting the tree that produced it, supposed it to be the production of some unknown submarine plant. It has often been found on the coasts of Ceylon and the Maldive Islands, drifted thither by some of the mysterious currents which perplex mariners all over the Indian Ocean. The nuts attained in these countries to an almost religious value, and were sold in India for fabulous prices. A

* In a letter received from Mr. Ward, he requests me to accompany this communication with a statement that several of the facts here described were also noticed by Dr. Barnard, and published in a volume of the Asiatic Society's Journal, and that these have all been verified by himself.—W. J. Hooker.

medicine was made of the kernel, which was said to possess restorative qualities much in request in those countries where polygamy prevails.

It was not until the discovery of the Seychelles Islands by the French in 1742 that authentic information was obtained respecting the true nature of the tree, and the astonishment of those previously acquainted with the Coco de mer may well be imagined upon their finding large forests entirely composed of this Palm, growing most luxuriantly upon a small and quite uninhabited island, and towering far above all ordinary tropical vegetation.

But little is even now known respecting the growth and peculiarities of this extraordinary Palm, owing to the great length of time it requires to arrive at maturity, and the consequent difficulty of obtaining accurate information with regard to its development. The information gathered from the inhabitants is not of much value; they are very unobservant, and the truth of their replies to any questions that may be put to them can never be depended upon.

The shortest period before the tree puts forth its buds is thirty years, and one hundred years must elapse before it attains its full growth. No one can tell how long it will last, or how old some of the gigantic specimens may be. No nuts planted since the British came into possession have arrived at their full growth. One in the garden at Government House, planted fifteen years ago, is still quite in its infancy, about sixteen feet in height, but with no stem yet visible, the long leaves shooting from the earth like the Traveller's Palm (*Urania speciosa*), and much resembling them in shape, only much larger. Nine months after the nut has been planted, supposing germination to have begun at once, the leaf sprouts at an angle of 45° from the root; it is very closely folded, with a smooth hard surface, terminating in a sharp point. When about two feet above the surface it expands, and nine months after another leaf follows, coming up the grooved surface of the midrib of that which preceded it, and so on at intervals of nine months, each succeeding leaf becoming larger in size. All these leaves cluster together and support each other, no stem appearing above the ground. From the age of fifteen to twenty-five the tree is in its greatest beauty, and the leaves at this period much larger than they are subsequently. They consist of two layers of fibres crossing each other at right angles, imbedded in a thick stratum of parenchyma enclosed in a tough skin.

The stem of the full-grown tree, like that of all Palms, consists

of hard fibres imbedded in medullary substance enclosed in a hard sheath, so hard that a good axe is required to cut it. It splits readily, but is extremely durable. Unlike the Cocoa-nut trees, which bend to every gentle gale (*flecti sed non frangi*), and are never quite straight, the Coco de mer trees are as upright as iron pillars (*frangi sed non flecti*), undisturbed in their position by the heavy gales and violent storms so often occurring in tropical regions.

At the age of thirty the tree first puts forth its blossoms. The male and female trees are quite distinct; and the female blossom may be considered as the germ of the nut, as it offers nothing of the appearance of what is generally regarded as a blossom. The female tree alone produces the nut, and it is twenty feet shorter than the male tree, which frequently attains a height of one hundred feet.

The male flower is an enormous catkin, about three feet in length and three inches in diameter, of a reddish-brown colour, and covered with rhomboidal valvate scales disposed spirally about the stem, from the angles of which the stamens spring. Within its circumference, at intervals corresponding to the apertures from which the stamens shoot, are found little masses containing such a succession of stamens in progressive stages of development that the flowering is maintained for eight or ten years, each coming stamen thrusting off and replacing the one that preceded it. The whole has a most disagreeable, oily odour, and if cut and put in any accessible place, is greedily attacked by ants. It may be seen in all stages upon the same tree—in full bloom, faded, and quite decayed.

The female blossoms spring from a strong stem forming a regular zigzag, and are composed of three bracts three or four inches in diameter. A gummy secretion exudes from the apex of these, which secretion doubtless arrests and secures the pollen necessary for their fecundation. The fruit-stalk is supported by three very strong bracts; the outer one of these, the top of which is wedge-shaped, penetrates the stalk of the leaf immediately above it, in the under side of which nature has left a fissure accessible to it. By this provision the stalk is enabled to support the weight of fruit which hangs upon it, sometimes exceeding four hundredweight. Eleven nuts have been seen on one stalk, the probable weight of each being about forty pounds. Such clusters are, however, very rare, and four or five may be taken as the average number on one stalk.

From fructification to full maturity a period of nearly ten years elapses. The fruit attains its full size in about four years, and is then soft, and full of a semitransparent jelly-like substance of an insipid, sweetish taste. The mesocarp is a leathery substance of a brownish-green colour, adhering to the shell. As the nut ripens this gradually dries up into a white, horny kernel, about half an inch in thickness, and of no use whatever, supposed to be poisonous, but, probably, only quite indigestible. The nut in its perfect state is about eighteen inches long, and of the same breadth, something in the shape of a heart, with two separate compartments. It is enveloped, like the Cocoa-nut, in a fibrous husk; but its texture is not nearly so thick or so strong, and it drops off soon after the nut falls from the tree. The nuts, sawn in half and divested of the kernel, form excellent calabashes, and are universally used for baling boats. The entire nut is frequently used as a water-keg, and holds three or four gallons of water. It has, however, to be "caulked" in the centre, where germination takes place, before it becomes completely water-tight.

The arrangements provided by nature for the roots of both male and female trees are of a most peculiar nature, quite distinct from those provided for any other known tree. The base of the trunk is of a bulbous form, and this bulb fits into a natural bowl, or socket, about two and a half feet in diameter and eighteen inches in depth, narrowing towards the bottom. This bowl is pierced with hundreds of small oval holes about the size of a thimble, with hollow tubes corresponding on the outside, through which the roots penetrate the ground on all sides, never, however, becoming attached to the bowl; their partial elasticity affording an almost imperceptible but very necessary "play" to the parent stem when struggling against the force of violent gales.

This bowl is of the same substance as the shell of the nut, only much thicker. As far as can be ascertained, it never rots or wears out. It has been found quite perfect and entire in every respect sixty years after the tree has been cut down. At Curieuse many sockets are still remaining which are known to have belonged to trees cut down by the first settlers on the island.

This curious arrangement renders it impossible that the trunk could grow in a slanting position; and there is no known instance of its doing so, either on the flat, or on the steep sides of the mountains, in both of which situations the tree thrives equally well.

The high price still fetched by the nuts will ultimately be the cause of their complete extinction in these islands. The growth

of the Palm is so very slow that no one can expect to reap where he has sowed, and the people consequently never take the trouble to plant any for the benefit of posterity. Not content too with digging up those nuts that have fallen and taken root, they ruthlessly destroy whole trees by cutting them down for the sake of the nuts and the heart leaves, which latter are used for making hats, fans, and baskets. Many of the trees still standing are quite spoilt by the practice of cutting out these centre, or heart, leaves, leaving the tree shorn of its beauty, and with an untidy, ragged appearance. Besides the ravages of man, fire is a terrible enemy to these forests, a year seldom elapsing without their being sufferers by accidental conflagrations, especially those forests situated at the north-west end of Praslin, in which are now found only such male trees that from their height overtopped the flames that destroyed the females. At the south-east end of Praslin they are more plentiful, the dry season being in the south-east monsoon, and as the forests are to windward, they are not exposed to much danger from spreading fire.

No suggestions will induce proprietors to abandon their present habit of wilfully destroying the trees for the sake of the nuts and leaves, or to take some pains for the cultivation and reproduction of this magnificent Palm. Not many years will elapse before the Coco de mer becomes in reality as rare as it was supposed to be when first picked up at sea by the wondering mariners, and the only relics left of its former magnificence will be the decaying blackened stumps of the trees so wantonly destroyed, and the curious sockets in which they stood for so many years.

Seychelles, April 16, 1863.

Observations on a peculiar Mode of Fructification in *Chionyphe Carteri*, Berk. By the Rev. M. J. Berkeley, M.A., F.L.S.

[Read March 3, 1864.]

[Plate X.]

I have given, in the 'Intellectual Observer' for November 1862, an account of that formidable disease, the Fungus-foot of India, from information derived partly from Dr. H. Vandyke Carter and partly from his colleague Mr. H. J. Carter, together with a figure of the curious mould to which it is believed that it owes its origin. The latter gentleman, besides placing all his sketches at my disposal, gave me specimens of the mould, in such a condition

that it was hoped I might be able to raise a crop in the following spring upon rice-paste, to enable me to examine its characters more closely than Mr. Carter had been able to do, as he had not made an especial study of the minute Fungi.

It was the more desirable to do this as the *Chionyphe* as seen by Mr. Carter exhibited more than one form of fructification, in one of which a multitude of globose spores were formed within the terminal cyst; in another, if not an earlier stage of the same thing a few secondary cysts were produced within the mother cyst; while in a third, instead of globose spores there were myriads of more minute fusiform bodies. These secondary cysts, it should be observed, are unlike anything observed hitherto in *Chionyphe* or *Mucor*, though approaching certain appearances in *Saprolegnia* and its allies.

The resemblance, however, to these plants did not stop here, for in certain cysts lateral branchlets formed a reticulated mass over the surface, reminding one strongly of the antheridia in *Saprolegnia monoica*, Pringsheim*, or of the supposed antheridia figured by Hofmeister† in Truffles.

Those who are familiar with the various modes of fructification in Fungi, and more especially if they have studied the *Saprolegniæ*, will not be surprised at these anomalies, or at the additional proofs afforded by them of the affinity which really exists between the *Mucorini* and *Saprolegniæ*.

As early as 1823, Carus‡ observed that of two portions of a dead salamander which was infested with some incipient mould, one which was immersed in water produced an *Achlya*, while that which was kept moist in air gave rise to a species of *Mucor*. This was hailed as a strong argument in favour of the theories then prevalent in Germany relative to equivocal generation; but it was, in fact, an indication of that plurality of forms of fruit which is now known to exist in so many Fungi. The relation has not, however, been generally acknowledged, insomuch that the *Saprolegniæ* have by most authors been referred to Algæ rather than to Fungi. Later discoveries, however, of the existence of spores resembling Infusoria in the genus *Peronospora*, to which the Potato-mould belongs, not to mention the Myxogastres, have apparently modified opinions, and at the present moment botanists seem inclined to acknowledge the justice of the views I have

* Jahrbücher für wissenschaftliche Botanik, Band 1. tab. 19.

† Pringsheim, Jahrbücher, Band 2. tab. 33–35.

‡ Act. Leop. 1823, tab. 58.

entertained on the subject in the 'Introduction to Cryptogamic Botany,' p. 10.

On every account, therefore, it was a matter of some interest to watch, if possible, the development of the *Chionyphe*. As soon, then, as the weather was sufficiently warm in the spring of 1863, minute fragments of my specimens were placed upon thick rice-paste, and each was covered with a bell-glass to prevent any accession of fresh spores from without. Unfortunately, however, our native moulds rapidly made their appearance in great abundance, and it was only after they had arrived at perfection that the pink patches of the *Chionyphe* became conspicuous, and these were so intermixed with the strangers that it was very difficult to follow out their development; added to which the rice-paste seemed to be so exhausted by the first-formed moulds, that the vegetation of the *Chionyphe* ceased before the greater part of the fruit was perfected. As far, however, as my observations go, they confirm Mr. Carter's remarks. There were two kinds of *Hyphasma,* the one consisting of irregular branched and anastomosing, sparingly-jointed threads, which seemed to give rise to the Mucorioid fruit; the other of straight Confervoid threads (which appear to be identical with those figured by Mr. Carter), in whose articulations there was a minute nucleus at the upper part, while in the terminal articulation there were sometimes two, though I was not able to verify this minute character. There were the same cysts of the second order in some of the mother cysts, and there were spores germinating *in situ,* though these appeared to me elliptic rather than globose.

Though, however, I did not see all that Mr. Carter has figured, a most curious matter, in addition, was exhibited by the straight threads, which point to another curious analogy with certain Algæ.

The portion of the protoplasm or contents of the cells in which Mr. Carter observed the nucleus above mentioned to be immersed soon separated from the rest, first presenting a cask-shaped mass, surrounded or not with a distinct membrane, and then becoming elliptic or subglobose. A large nucleus was observed in many of these masses, but this appeared to be frequently replaced by an indefinite number of smaller bodies. After a time a little papilla is formed on one side exactly as in the fructifying joints of *Zygnema,* which gradually bulges out, the mass soon conforming itself more or less to its enlarged walls. In a single case only I witnessed the junction with another thread (Pl. X. fig. 6),

and then the form of the intermediate cyst was extremely irregular and its cavity filled with large spores.

In some threads, however, a different state of things appeared, sometimes in the centre, sometimes at the apex, but whether in either case corresponding with a twin nucleus I am unable to say. However this may be, instead of one cyst, two appeared, a conjugation probably taking place between the two within the thread, as in some *Zygnemata*, and the upper forming it should seem ultimately the perfect cyst. Not one cyst, however, came to perfection. In some cases (fig. 4) the lower cyst seemed to be entirely absorbed, while in others (fig. 5) it was permanently connected with the upper by a distinct neck. In one instance I saw one of the straight threads forked, and producing two terminal cysts.

From the circumstances before mentioned, it was impossible for me to follow out each point with the requisite precision, and I ought perhaps to apologize to the Society for submitting to it observations confessedly so imperfect. As, however, they relate to an extremely interesting matter and are highly suggestive, while, as far as they go, they give evidence of the correctness of Mr. Carter's sketches, I have imagined that they may possess sufficient importance to command a moment's attention. The conjugation of the threads seems to resemble more closely that of *Zygnema* than the well-known analogous phenomenon in the genus *Syzygites*.

EXPLANATION OF PLATE X.

Fig. 1. A portion of the *Hyphasma* which gives rise to the Mucorioid cysts, figs. 7 & 8.

Fig. 2. Straight threads with one or two nuclei at the upper part of each articulation: after Mr. Carter.

Fig. 3. Separation of cysts from the protoplasm in different states.

Fig. 4. A double cyst formed in one of the joints, and a cyst which has become free above, the second cyst having been absorbed.

Fig. 5. Various threads in which a double cyst has been formed above, and a single cyst in one or more of the central articulations. In one a lateral cyst has been formed at the apex.

Fig. 6. An irregular cyst filled with spores formed by the junction of two threads.

Fig. 7. Mucorioid cysts, in one of which spores have been formed, while in two there are secondary cells. There is no columella as in *Mucor*.

Fig. 8. Spores germinating *in situ*.

All the figures are more or less magnified.

Note to the above Paper, by the Secretary.

[Plate XI.]

Since the reading of Mr. Berkeley's paper, the Secretary has been favoured with a letter from Mr. H. J. Carter, enclosing tracings of his original drawings of *Chionyphe Carteri.* From these tracings the accompanying woodcut and the figures in Plate XI. have been made; and, with Mr. Carter's permission, the substance of the letter is here given, together with an explanation of the woodcut and Plate:—

"I send you the tracings of my drawings of the elements of the Fungus-disease of India, now called by Dr. H. Vandyke Carter '*Mycetoma*'; and also of the Red Fungus, which appears to be its free form, now called by Mr. Berkeley '*Chionyphe Carteri.*'

"The discovery of both forms is due to my friend and namesake Dr. H. Vandyke Carter, and all that I have added to his investigations (which are chiefly pathological) is a special examination of them for the purposes of natural history.

"In doing this, my object in the accompanying delineations has been to give elementary representations of *each* state of the fungus; not of what any single portion placed under the microscope would afford, but a combination of what is presented generally; so that the fungologist may be able at once to see all the different elements of which each form of the fungus is composed.

"Dr. H. Vandyke Carter's papers are to be found in the 'Transactions of the Medical and Physical Society of Bombay,'—

No. 6 (new series), p. 104, 1861.
No. 7 (new series), p. 206, 1862.
No. 8 (new series), Appendix, p. xxvi, 1863.

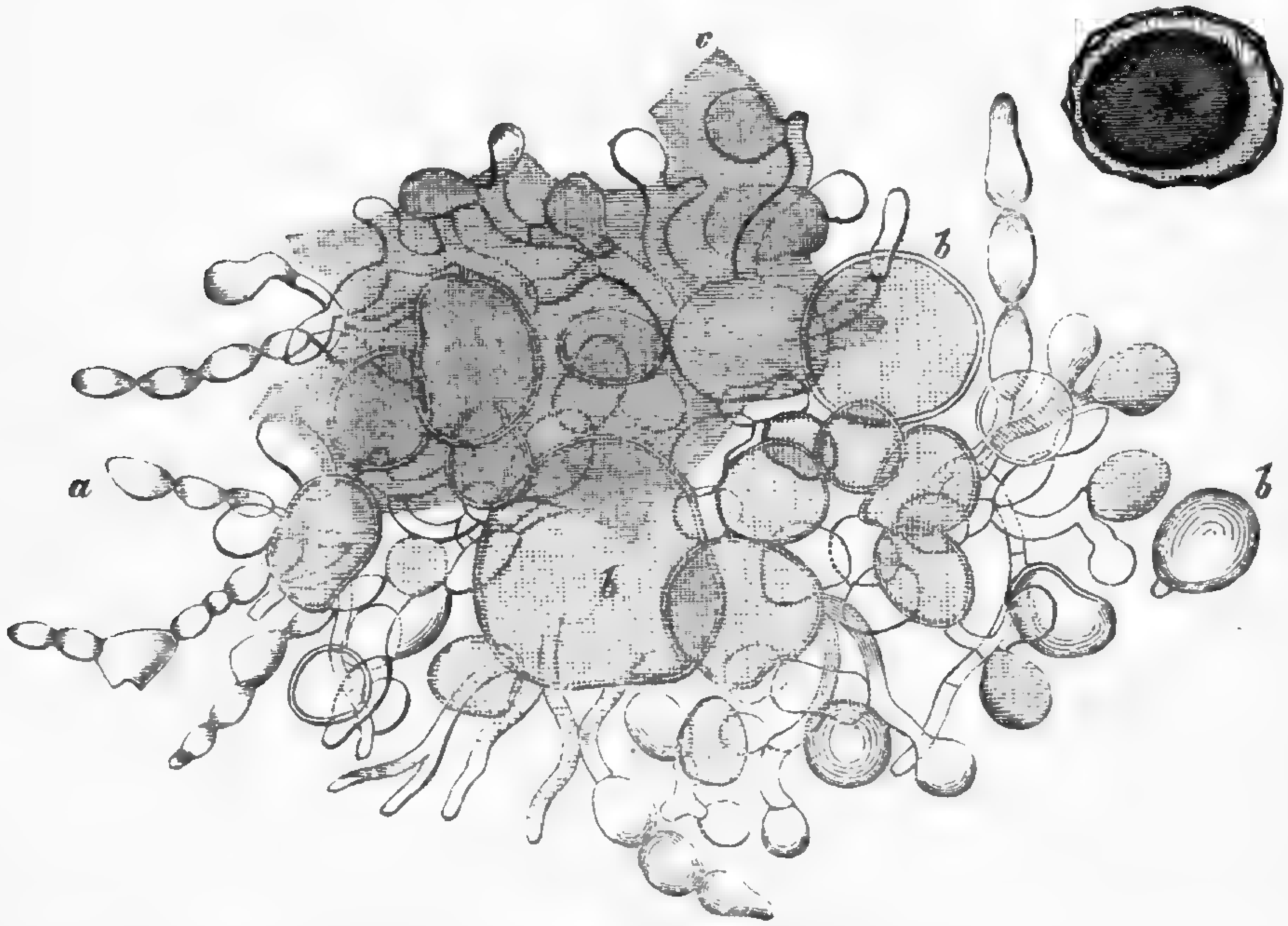
In the latter, Dr. Carter states that he has found the 'red mould,' i. e. *Chionyphe Carteri*, growing directly from the 'fungus-particles' of *Mycetoma*.

"The little I have written on the subject may be found in the same journal (No. 7, Appendix, p. i, 1862); also in the Ann. and Mag. of Nat. Hist. vol. ix. p. 442 (June 1862), and at p. 445, *foot-note*, is my diagnosis of the fungus of *Mycetoma*; while in the 'Intellectual Observer' for November 1862, p. 248, will be found Mr. Berkeley's observations on the subject, wherein he calls the 'red mould' *Chionyphe Carteri*.

"It was from seeing the drawing of *Chionyphe*, with these observations, that I came to the conclusion that the plant had not

grown so vigorously with my kind friend Mr. Berkeley (from the dry rice-paste including its spores that I brought home from India) as in its native country, and therefore offer you (for the

Fig. 1. Fig. 2.



Society) tracings of my drawings of it as it appears under more favourable circumstances, and thus better developed."

EXPLANATION OF WOODCUT.

Fig. 1. A combination of the elementary parts of *Mycetoma*, on the scale of $\frac{1}{12}$th to $\frac{1}{5400}$th of an inch, showing—*a*, filaments; *b b b*, large cells growing on the ends of the filaments (abortive sporangia?); *c*, shade, showing flakes of concretionary brown matter, originally derived from the bursting of the abortive sporangia (?), which, in aggregation, thus gives the dark "vandyke-brown" colour to the general mass of *Mycetoma*. The natural tint, when minute portions are torn to pieces for microscopical examination, is light brown. See my descriptions of all this in the 'Annals,' *loc. cit.* The drawing was made from portions of *Mycetoma* taken from a foot *only half an hour* after it was amputated.

Fig. 2 represents one of the large cells, or abortive sporangia, acted upon by a solution of iodine in iodide of potassium, under which its contents indicate, by their tint, a strong admixture of starch.

EXPLANATION OF PLATE XI.

Fig. 1. A combination of the elementary parts of *Chionyphe Carteri*. Some o the filaments are red; others present only the yellow or opalescent tints of the oleaginous or albuminous globules which they contain. The same is the case with the sporangia and the sporidia as to colour. The cell-wall of the sporangia presents a wavy appearance, probably

from wrinkling. The sporangia also show the formation of the sporidia in different stages, that is, the resolution of their contents into sporidia. One has burst, and shows the suspending mucilage of the cell to be coloured, as well as that of the contents of the sporidia. They are, for the most part, covered with a network of smaller filaments, which seem to spring from the same filament on which the sporangium is borne. What the office of this may be I cannot say, unless it be connected with impregnation, after the manner pointed out by Pringsheim in *Saprolegnia*, &c. The drawing also shows sporidia in process of germination. The whole on the scale of $\frac{1}{12}$th to $\frac{1}{5400}$th of an inch, *i. e.* on the same scale as that of *Mycetoma*.

Largest sporangium $\frac{13}{5400}$ diam.; sporidium $\frac{1}{5400}$ long, oval, acuminate; filament $\frac{1}{5400}$ across, in long cells, with the nucleus at the upper end. See fig. 2.

Fig. 2. Filament, more magnified.

Fig. 3. Sporidia, more magnified.

Fig. 4. Greatly magnified view of the layer of *Chionyphe Carteri*, as it grows over the surface of the water in the glasses containing portions of the foot affected with *Mycetoma*, after the latter have been placed aside for maceration. Vertical section, showing—*a*, the upper layer of filaments; *b*, the middle layer, where the sporangia are chiefly formed; and *c*, the lower layer, composed chiefly of its mycelium.

I could not get the *Chionyphe* to grow on paste after the spring and beginning of summer, and therefore infer that this is the time at which it fructifies, which it did at first vigorously on the rice-paste; in June the formation of spores began to cease, and shortly afterwards all the spores were discharged, and, together with the ruptured membranes of the sporangia, were found scattered throughout the remaining filamentous mass.

On the Identity of *Pinus Peuce*, Griseb., of Macedonia, with the *P. excelsa* of the Himalaya Mountains. By J. D. Hooker, M.D., V.P.R.S. & L.S.

[Read March 3, 1864.]

In 1839 Dr. Grisebach, now the eminent Professor of Botany in Göttingen, but then travelling on a scientific mission in Rumelia and the neighbouring countries, discovered a small forest of a very peculiar-looking five-leaved Pine, evidently new to Europe. The locality (a very confined one) was on Mount Peristeri, above Bitolia, in Southern Scardus (an eastern district of Macedonia bordering on Dalmatia), lat. 41° N., long. 21° E. There this Pine forms an interrupted wood of distant trees, growing in a granite soil, between the elevations of 2400 and 5800 feet (German), amongst a dense undergrowth of Oxycedrus and Juniper; only young cones were found (in July). The height of the tree

varies from 40 feet at its lowest altitude to a tortuous bush 4 feet high at its uppermost.

In Dr. Grisebach's narrative of his journey this Pine was regarded as a variety of *P. Cembra,* the only other five-leaved Pine of Europe; but in his excellent 'Spicilegium Floræ Rumelicæ et Bithynicæ' (ii. 350) it is described as a new species, intermediate between *P. Strobus* and *P. Cembra.* Unfortunately in that work the seed is stated in the diagnosis not to be winged, and, in the detailed description, to be surrounded with a narrow wing only, instead of having the large broad wing of *P. excelsa* and *P. Strobus.* This observation seems to have misled all succeeding botanists, as Endlicher, Loudon, Gordon, &c., who have all referred *P. Peuce* to the *Cembra* group.

Nothing further seems to have been known of this plant for a quarter of a century, indeed till the other day, when Messrs. Haage and Schmidt, of Erfurt, sent to Sir W. Hooker branches with ripe cones, gathered in the forest that Dr. Grisebach discovered, by M. Orphanides, late Curator of the Royal Gardens at Athens. These, on being received at Kew, were at once recognized as being identical with either *P. excelsa* of India or *P. Strobus* of America, and inquiries were instantly made of Messrs. Haage and Schmidt as to the authority for the habitat, &c. Every confirmation was at once supplied, and Dr. Grisebach, who has since been communicated with, has also expressed his opinion of the genuineness of the rediscovery. Messrs. Haage and Schmidt also, at our suggestion, compared the specimens and seeds with those of *P. excelsa,* and pronounced them identical with the latter.

It only remains to observe, that we have again carefully examined *P. Peuce,* and failed to find any difference between the Indian and Macedonian plants. The former is one of the best-known Himalayan trees, extending throughout the whole range of the Himalaya, from Assam to Afghanistan (the small province of Sikkim alone excepted), at elevations of from 4000–8000 feet. In the more humid eastern districts its leaves are longer and more flaccid; in the drier western, shorter, and altogether similar to those of *P. Peuce.* It has been found nowhere between Macedonia (long. 21° E.) and Afghanistan (long. 70° E.), an extent of upwards of 2200 miles.

It is not my purpose to enter into any discussion upon the many curious reflections to which this interesting discovery must give rise, of which the most noticeable are, that no record of a plant so conspicuous, and so widely different from any known

European Conifer, should exist in the writings of the Greeks, and that it should not have attracted the attention of any other modern traveller than the distinguished botanist to whom we owe its discovery in Europe.

Further, the bearing of this fact in geographical distribution upon our modern speculations as to the origin and migration of existing species is indeed most suggestive; and that a plant so well marked should have disappeared over an area of 2200 miles, and yet retained its characters apparently unaltered during the ages that have elapsed in the interval represented by this extinction, and regardless of the vast geographical and climatal changes that must have determined its present limitation, is one of the most interesting problems that has ever been unfolded to us by the history of any European tree.

Dimorphism in the Flowers of *Monochoria vaginalis*. By JOHN KIRK, M.D. Communicated by the President.

[Read April 7, 1864.]

THIS plant is found in the shallow lagoons of the Zambesi, and in mode of flowering presents two very distinct forms. The usual inflorescence is a spike 3–4 inches long, with a membranous spathe at base, arising from the sheathing petiole of the leaf. At the time of flowering this is raised above the surface, again descending to mature its fruit.

The second form of inflorescence consists of a solitary, almost sessile flower, produced at the base of the leaf-stalk, and included in its sheath. This is never raised above the surface of the water. In addition, each flower is protected by a short sac, formed of the membranous spathe, without any opening or fissure; within this flowering and fecundation go on; nor is it until after the capsule has become enlarged that this sac is ruptured.

The perianth consists of a single three-toothed ring, having on the inner surface of one of its segments a solitary stamen, two-celled, and opening by longitudinal valves. The ovary presents no difference, but resembles that of the normal flower; the style, however, is almost obsolete; the three stigmatic surfaces almost sessile at the apex of the ovary, and directed to one side. No marked difference is to be observed between the ripe capsules;

both contain many perfect seeds; but the solitary or abnormal form seems to be commonly rather larger.

The Hookerian Herbarium contains specimens of the plant from various parts of tropical Africa, and all present the double type of flowering, which is not so obvious in those of India and Australia.

On some Species of *Musci* and *Hepaticæ*, additional to the Floras of Japan and the coast of China. By William Mitten, A.L.S.

[Read April 21, 1864.]

The first list of the species of Musci from Japan and the adjacent islands was published in 1859, in the 'Proceedings of the American Academy,' by Messrs. Sullivant and Lesquereux, from the collections made during the American Exploring Expedition under the command of Captain Rodgers; seventy-eight species in all were enumerated, of which twenty-four were considered new, and the remainder referred to known European and North American forms. In the collection made in 1861 by Mr. Oldham, and now in the Herbarium of Sir W. J. Hooker, the proportion of European forms is much less, and is represented rather by cosmopolitan species than by any referable to particular areas, and it would appear that the Musci of Japan consist of a mixture of the forms of northern temperate regions with others principally tropical, and these corresponding very nearly with those of the Indian Archipelago, whence it is probable that a very large number of species will be found to inhabit the islands included in Japan.

MUSCI.

DICRANACEÆ, *Mitten*.

Didymodon, *Hook*.

D. crispifolius, sp. nov. Monoicus, cæspitosus, caule parce ramoso, foliis e basi erectiore subrotundata subulatis longe lineari-lanceolatis patenti-incurvis siccitate laxe crispatis, nervo percurrente apice dorso pauci-denticulato, marginibus e medio ad apicem remote serrulatis, cellulis basi ad angulos oblongis hyalinis inde cito in minutas rotundatas luteas papillosas transeuntibus, perichætialibus basi magis convolutis, theca in pedunculo gracili pallido luteo inclinata obovata curvata lævi basi strumosa, ore magno, operculo conico curvirostrato, calyptra capsulæ ¾ obtegente, peristomio dentibus validis rubris di-

cranis, flore masculo gemmiformi compresso in foliorum infra perichætium axillis insidente.

Hab. Nagasaki, Japan, *Oldham.*

About one inch high. Whole plant pale yellowish green, becoming in the older parts fulvous. Allied to *D. polycarpus* (Ehrh.) and *D. strumifer* (W. et M.), but a little more robust and with more spreading leaves.

Belonging to this group, and enumerated by Sullivant and Lesquereux, are—

Cynodontium pallidum (Schreb.), of which a single stem was found loose amongst Mr. Oldham's specimens, and very fine specicimens were gathered by Mr. Fortune in the province of Chekiang.

Pleuridium subulatum, Brid. A single stem intermixed with Mr. Fortune's specimens above named.

A species of *Campylopus*, very near to, if not identical with, the *C. nigrescens* of India, was gathered by Mr. Oldham on rocks at Nagasaki in a barren state, and several species in the same imperfect condition have been received from Hongkong.

LEUCOBRYACEÆ, *C. Müller.*

SCHISTOMITRIUM, *Dzy. et Molk.*

S. GARDNERIANUM, *Mitten.*

Hab. On pine-trees, Nagasaki, Japan, *Oldham.*

The specimens are barren, but appear to belong to this species.

GRIMMIACEÆ, *Mitten.*

GLYPHOMITRIUM, *Brid.*

G. DENTATUM, sp. nov. Laxe cæspitosum, caule procumbente parce ramoso, foliis patulis e basi elliptica lanceolatis obtusiusculis acutatis, nervo sub summo apice evanido, margine e medio ad apicem remotiuscule dentato, cellulis basi infima paucis parallelogrammaticis mox in quadratas superne in minutas rotundatas distinctas transeuntibus, perichætialibus conformibus, theca in pedunculo brevi ovali aurantiaca, operculo subulato, peristomio e dentibus brevibus rubris integris divisisve, calyptra thecam ad medium tegente.

Hab. Nagasaki, Japan, on rocks, *Oldham.* Sam-Sa Bay, China, *Alexander.*

Near to *G. lepidomitrium*, C. Müller, from Mexico, but the leaves are wider above.

G. SINENSE, sp. nov. Compacte pulvinatum, caule simplici, foliis patentibus incurvis e basi ovali lanceolatis, nervo crassiusculo in apice evanido, marginibus superne incurvis integerrimis, cellulis basi ob-

longis mox in quadratas superne minutas rotundatas subobscuras transeuntibus, perichætialibus conformibus, theca in pedunculo elongato rubro cylindrica pallide fusca, operculo subulato pallido, peristomio dentibus brevissimis flavis punctulatis, annulo composito, calyptra thecam ad basin obtegente eamque amplectente.

Hab. Japan, *Oldham.* China, Nan-kong-foo, by the cataract Kiang-si, *Alexander.*

In compact roundish tufts of a blackish-green colour. In its stems and foliage similar to *G. crispatum*, Hook., but the leaves more acute, and the capsule on a longer seta, which gives the plant at first sight more the appearance of a *Tortula.*

A very few stems, belonging to all appearance to *Grimmia apocarpa*, L., were intermixed with *Stereodon Oldhami.*

ORTHOTRICHACEÆ, *Mitten.*

Macromitrium, *Brid.*

M. rupestre, sp. nov. Dioicum, caule prostrato repenti fusco radiculoso ramis brevibus densifoliis late cæspitoso, foliis rameis humidis patentibus apicibus incurvis, siccitate incurvatis contortis ligulato-lanceolatis, inferioribus apice obtusis subcucullatis acutatisve, superioribus acutis, nervo percurrente carinatis, marginibus integerrimis, cellulis inferioribus parvis oblongis pellucidis, uno latere in basi infima ad nervum paucis majoribus hyalinis, superioribus parvis rotundatis obscuris, perichætialibus dimidio brevioribus erectis, theca in pedunculo elongato gracili pallide aurantiaca ovali versus os intensiore colorata plicata gymnostoma, operculo e basi convexo subulato, calyptra nuda thecam ad medium tegente.

Hab. Rocks at Nagasaki, Japan, *Oldham.*

Growing in extensive patches; the younger leaves yellowish, the older brown; the calyptra is small, and more deeply split on one side. A more slender species than *M. spathulare*, Mitten, from Hongkong, which has, too, a shorter seta and pilose calyptra.

BARTRAMIACEÆ, *Mitten.*

Bartramia, *Hedw.*

B. pomiformis, *L.*

Hab. Nagasaki, Japan, *Oldham.*

Philonotis, *Brid.*

P. palustris, sp. nov. Monoica, cæspitosa, caule elongato inferne radiculoso tomentoso, foliis subsecundis lanceolatis, nervo breviter excurrente, marginibus serrulatis, cellulis elongatis pellucidis papillosis

interstitiis teneris basi paucis brevioribus, foliis rameis carinatis, perichætialibus e basi latiore ovata subulato-lanceolatis, theca in pedunculo elongato rubro globosa horizontali plicata, operculo conico-convexo, peristomio normali?, flore masculo perichætio proxima.

Hab. In a marsh in the hills, Pi-quan Island, China, *Alexander.*

Very similar to *P. radicalis* (Beauv.), but the leaf is wider and more laxly areolate, the nerve not denticulate on the back. The male flower has not been seen.

P. LANCIFOLIA, sp. nov. Dioica, cæspitosa, caule elongato, foliis erecto-patentibus subsecundisve anguste elliptico-lanceolatis sensim tenuiter acuminatis, nervo excurrente, marginibus revolutis serrulatis, cellulis elongatis papillosis basi paucis subquadratis, perichætialibus internis ovato-lanceolatis subplicatis integerrimis, externis e basi latiore sensim subulato-lanceolatis, theca in pedunculo elongato rubro globosa plicata inclinata, peristomio normali?, dentibus parvis luteis brevibus.

Hab. Rocks at Nagasaki, Japan, *Oldham.*

Glaucous green. In size similar to small forms of *P. fontana* (L.), and allied to *P. mollis*, Dzy. et Molk., but differing in its more elliptical leaf, the widest part being about the middle.

P. SOCIA, sp. nov. Dioica, laxe cæspitosa, caule brevi, foliis erecto-patentibus subsecundis anguste ovato-lanceolatis, marginibus recurvis serrulatis, nervo excurrente, cellulis elongatis angustis basi abbreviatis parvis quadratis, perichætialibus e basi ovata longe subulatis, theca in pedunculo elongato rubro globosa inclinata plicata, operculo conico, peristomio dentibus brevibus rubris, interno processibus ¼ brevioribus punctulatis, ciliis singulis brevibus interpositis.

Hab. Nagasaki, Japan, *Oldham.*

Pale green. Similar to *P. Muhlenbergii* (Schw.), but with shorter leaves.

BRYACEÆ, *Mitten.*

BRYUM, *Dill.*

B. SCABRIDENS, sp. nov. Dioicum, caule brevi, foliis erecto-patentibus lanceolatis acutis, nervo percurrente, marginibus apicem versus serrulatis, cellulis elongatis angustis, perichætialibus subulato-lanceolatis marginibus recurvis, theca in pedunculo prælongo rubro elliptico ovali horizontali, operculo conico acuminato brevirostrato, peristomio dentibus e medio ad apicem rugulosis punctatis, interno processibus angustis perforatis rugulosis punctatis, in membrana ad tertiam partem longitudinis dentium exserta, annulo composito.

Hab. On damp ground in shady places, Nagasaki, Japan, *Oldham.*

Closely resembling *B. flexuosum* (Harvey). Improperly referred to *Webera* in the 'Musci Indici.'

B. CAPILLARE, *Hedw.*
Hab. Rocks, Nagasaki, Japan, and on the City wall, Ningpo, China, *Oldham.*

MNIACEÆ, *Mitten.*

FISSIDENS, *Hedw.*

F. JAPONICUS, *Dzy. et Molk.*
Hab. Nagasaki, Japan, *Oldham.*

A few fragments only, picked out from *Marchantia nitida.*

F. ADIANTOIDES, *L.*
Hab. Hongkong, *Bowring*; Sam-Sa Bay, *Alexander.*

F. ZIPPELIANUS, *Dzy. et Molk.*
Hab. Hongkong, *Bowring.*

MNIUM, *Dill.*

M. RADIATUM, *Wils.* M. flagellare, *Sullivant et Lesquereux.*
Hab. Nagasaki, Japan, *Oldham.*

Allied to *M. Menziesii*, Hook.

M. ROSTRATUM, *Hedw.*
Hab. Nagasaki, Japan, *Oldham.*

M. INTEGRUM, *Dzy. et Molk.*
Hab. In running streams, Nagasaki, Japan, *Oldham.*

ANACAMPTODON, *Brid.*

A. FORTUNEI, sp. nov. Caule repenti vage ramoso intertexto, foliis patentibus ovato-lanceolatis sensim acutis, nervo crassiusculo excurrente, marginibus incurvis, cellulis brevibus oblongis, perichætialibus erectis convolutis ovali-lanceolatis, nervo tenui ultra medium evanido, theca in pedunculo semiunciali ovali siccitate sub ore constricta, operculo convexo rostrato, peristomio externo dentibus lanceolatis obtusis teneris dorso convexis, interno ciliis angustis dimidio brevioribus.
Hab. On oaks in woods, Province of Chekiang, China, *Fortune.*

Closely resembling *A. splachnoides*, Brid., and agreeing with it entirely in its capsule and peristome; but the operculum with its slender beak is different, and the leaves are narrower and have the nerve distinctly excurrent, the apex of the leaf being composed of it solely.

HYPNACEÆ, *Mitten.*

HYPNUM, *Dill.*

(*Rhynchostegium*, Schimp.)

H. INCLINATUM, sp. nov. Monoicum, caule procumbente ramis confertis cæspitosis, foliis subcompressis patentibus ovato-lanceolatis

acutis, nervo ad $\frac{3}{4}$ evanido, marginibus basi recurvis inde ad apicem serratis, cellulis elongatis angustis, perichætialibus e basi late ovali subulatis serrulatis brevinervatis, theca in pedunculo elongato lævi ovali inclinata, in collum sensim attenuata, operculo conico curvirostrato, peristomio interno processibus ciliis binis in unum conflatis subæquilongis, in membrana fere ad medium dentium longitudinis exserta.

Hab. Moist banks, Ohosima, Japan, *Oldham*, Oct. 1861.

Dull brownish green. In size and habit agreeing with *H. confertum*, Dicks., but more nearly allied to *H. rhaphidorrhynchum*, C. Müller, and, excepting that its seta is smooth, to *H. speciosum*, Wils. In the inclined capsule it resembles *H. murale*, Hedw., which has its fruit sometimes nearly erect.

H. PALLIDIFOLIUM, sp. nov. Monoicum, caule procumbente ramis laxis laxe cæspitosis, foliis compressis ovato-lanceolatis acuminatis, nervo ad $\frac{2}{3}$ evanido, marginibus serrulatis, cellulis elongatis angustis, perichætialibus e basi ovali subulatis integerrimis nervatis, theca in pedunculo gracili rubro horizontali ovali-cylindracea inæquali, peristomio interno processibus ciliis binis æquilongis trabeculatis in membrana ad tertiam partem dentium longitudinis exserta.

Hab. Nagasaki, Japan, *Oldham.*

Glossy pale green. Foliage much compressed, unaltered when dry; leaves less rigid than in *H. inclinatum* and more acuminate; perichætial leaves entire; capsule horizontal or drooping, and internal peristome different. It has somewhat the appearance of some states of *H. tenuifolium*, Hedw., but the leaves are more acuminated.

STEREODON, *Brid.*

(*Ctenidium*, Schimp.)

S. HASTILIS, sp. nov. Dioicus, cæspitosus, caule procumbente pinnato, foliis squarrosis e basi lata cordata subæquilatero-triangulari lanceolato-subulatis tenuiter acuminatis, foliis rameis lanceolatis, nervis obsoletis, marginibus serrulatis, cellulis omnibus elongatis angustis lævibus, perichætialibus erectis lanceolato-subulatis serrulatis, theca in pedunculo elongato rubro crassiusculo ovali, operculo conico, calyptra ramentis elongatis pluribus obtecta.

Hab. Nagasaki, Japan, *Oldham.*

In habit and appearance nearly allied to the *S. lichnites*, Mitten, of India, and to *S. pilosus*, Hook. f. et Wils., of New Zealand, but distinct in its leaves being attenuated from a wide triangular base. The calyptra is more pilose than in any species yet included in the small group of which *S. molluscus* (Hedw.) is the European form. The capsules are all too young, but appear to be arcuate.

(*Ctenium*, Schimp.)

S. Oldhami, sp. nov. Dioicus, dense intricato-cæspitosus, caule procumbente ramulis densis brevibus pinnato, foliis falcatis secundis lanceolatis e basi subovata sensim tenuiter angustatis superne serrulatis, nervis binis brevibus, cellulis omnibus elongatis angustis, perichætialibus internis ovatis subplicatis apice subulatis, theca in pedunculo elongato rubro ovali inæquali horizontali, operculo conico acuto, peristomio normali processibus solidis ciliis binis interpositis.

Hab. Rocks at Nagasaki, Japan, *Oldham.*

At first sight this moss has a striking resemblance to the smaller tufted states of *S. molluscus*, having the same soft yellowish appearance and similar ramification, but its affinity would seem to be with *S. plumæformis*, Wils., and *S. crista-castrensis* (L.).

S. plumæformis (*Wils.*).

Hab. Rocks, Nagasaki, Japan, *Oldham.*

The description of *Hypnum Rodgersianum*, Sullivant and Lesquereux, appears to indicate this fine species.

LEUCODONTACEÆ, *Mitten.*

Hedwigia, *Ehrh.*

H. ciliata, *Dicks.*

Hab. Rocks, Nagasaki, Japan, *Oldham.*

LESKEACEÆ, *Mitten.*

Anomodon, *Hook.*

A. tristis, *Cesati.*

Hab. Nagasaki, Japan, *Oldham.*

A. devolutus, *Mitten.*

Hab. City wall, Ningpo, China, *Oldham*; Hongkong, *Bowring.*

A. viticulosus, *L.*

Hab. City wall, Ningpo, China, *Oldham.*

Leskea, *Hedw.*

L. decurvata, sp. nov. Dioica, caule procumbente cæspitoso, ramis inordinatis ramosis apicibus secundifoliis decurvis, foliis imbricatis patentibus late ovatis acutis, nervo concolori percurrente, marginibus minute crenulatis, cellulis omnibus parvis ovoideo-rotundis distinctis subpellucidis minute papillosis, perichætialibus erectis ovato-lanceolatis sensim angustatis apice serrulatis, cellulis elongatis areolatis, theca in pedunculo elongato rubro cylindracea arcuata, operculo conico acuminato.

Hab. Rocks, Nagasaki, Japan, *Oldham.*

Habit, colour, and appearance altogether that of *L. polycarpa*, Ehrh.; but the areolation of the leaves is more dense, the cells being about half the size of those in that species, and the capsule, so far as can be seen from the unripe fruit on the specimens, is arcuate.

NECKERACEÆ, *Mitten.*

OMALIA, *Brid.*

O. NITIDULA, sp. nov. Caule humili, foliis compressis patentibus obovatis apice obtusis crenulatis angulo parvo terminatis, nervo tenui concolori medio evanido, cellulis apice ad marginemque lateris superioris ovoideis, reliquis e folii medio ad basin usque laterisque inferioris elongatis, omnibus pellucidis.

Hab. Nagasaki, Japan, *Oldham.*

Similar in size to *O. trichomanoides* (Schreb.), but with wider obovate leaves.

THAMNIUM, *Schimp.*

T. SUBSERIATUM (Neckera), *Dzy. et Molk.*

Hab. Nagasaki, Japan, *Oldham.* Moist places among rocks, Buffalo Bay, China, *Alexander.*

RHACOPILACEÆ, *Mitten.*

RHACOPILUM, *Brid.*

R. ARISTATUM, sp. nov. Caule repenti pinnatim ramoso radiculoso, foliis rigidulis statu sicco directione immutatis, lateralibus divergentibus ovali-oblongis acutis, nervo concolori in pilum viridem lævem excurrente, marginibus superne serrulatis, cellulis ovoideo-rotundatis, superioribus subhexagonis, foliis superioribus dimidio minoribus ovato-subulatis.

Hab. Yokahama, *Oldham.*

Intermediate in size between *R. spectabile*, Hsch., and *R. tomentosum*, Sw., with the foliage when dry retaining the same direction as when wet, but having the margins of the leaves involute.

HYPOPTERYGIACEÆ.

HYPOPTERIGIUM, *Brid.*

H. JAPONICUM, sp. nov. Synoicum, stipite brevi, foliis deltoideo-ovatis, superne in frondem parvam subdeltoideam ramosam, foliis parum asymmetricis ovatis, acumine brevi terminatis, limbo tenui pallido apicem versus denticulato circumductis, nervo infra apicem evanido, cellulis parvis ovoideo-rotundis, apice rotundis limitibus mollibus, foliis stipuliformibus suborbiculatis, acumine brevi subulato, nervo percurrente,

in rameis interdum sub apice evanido, perichætialibus parvis ovatis acuminatis, theca in pedunculo pallide fusco apice sublævi ovali elliptica in collum sensim angustata, peristomio normali.

Hab. Nagasaki, Japan, *Oldham.*

In size, colour, and appearance very closely resembling *H. Tibetanum*, Mitten, Musci Ind. Or.; but it differs from that species in its more regularly ovate leaves with longer nerves, and cells only half as large; the form of the capsule appears also to be different, it having with the thickened neck an elliptical outline, and when dry it is very much shrivelled up. The capsule of *H. Tibetanum* is more ventricose at the base and somewhat ovate in its form, not gradually attenuated into the neck, and retains the same form when dry.

POLYTRICHACEÆ, *Mitten.*

POGONATUM, *Brid.*

P. SPINULOSUM, sp. nov. Caule brevissimo, foliis e basi erectiore latiore subulatis breviter oblongo-lanceolatis incurvis, nervo crassiusculo percurrente superne dorso dentibus cristato, marginibus e basi ad apicem dense spinuloso-dentatis, perichætialibus erectis elongatis convolutis oblongo-lanceolatis acutis apice marginibus dorsoque denticulatis, theca in pedunculo elongato subcylindracea inæquali suberecta inclinatave, operculo convexo breviter curvirostrato, calyptra tomentosa thecam totam obtegente.

Hab. On the earth, Nagasaki, Japan, *Oldham,*

Nearest to *P. Gardneri*, C. Müller, but larger than Gardner's specimens, and differing from it and *P. Pennsylvanicum*, Hedw., in its perichætial leaves being more elongated, but with shorter points, and in the much more dentate lower leaves.

P. aloides, Hedw., has been gathered in Japan by Mr. Oldham, and in China by Mr. Fortune and Mr. Alexander.

HEPATICÆ.

SOLENOSTOMA, *Mitten.*

Plectocolea, subgen. nov.

Perianthium terminale, tubulosum, plicatum, ore denticulatum. *Caulis* ascendens. *Folia* explanata, disticha, pagina inferiore radicellis villosa. *Amphigastria* parva obsoletave.

S. RADICELLOSUM, sp. nov. Caule procumbente subsimplici crassiusculo, radicellis pallidis foliis adhærentibus, foliis subverticalibus suborbiculatis oblatisve patulis concavis, margine ventrali recurvis, dor-

sali decurrente, cellulis rotundatis, interstitiis teneris, marginalibus paululo majoribus subquadratis, involucralibus conformibus liberis parum majoribus, perianthio ovato pluries plicato, ore parvo truncato crenulato.

Hab. On moist earth, amongst *Marchantia nitida*, Nagasaki, Japan, *Oldham.*

This species agrees very nearly with *Jungermannia polyrhiza*, Hook., and forms with it and a few other Indian species a small group, remarkable for their plicate perianths and for the presence of root-like filaments on the underside of the leaves.

TRIGONANTHUS, *Spruce.*

T. DENTATUS (*Raddi*).

Hab. On earth, amongst the stems of *Pogonatum spinulosum*, Nagasaki, *Oldham.*

A few very small stems.

CHILOSCYPHUS, *Corda.*

C. ARGUTUS, *Nees ab E.*

Hab. Nagasaki, Japan, *Oldham.*

C. PLANUS, sp. nov. Caule procumbente vage ramoso subsimplicive, foliis explanatis subconvexis ovato-quadratis apice rotundatis, uni- vel sæpius truncato-bidentatis, rarius tridentatis, cellulis hexagonis chlorophyllosis, amphigastriis parvis discretis bifidis laciniis extus unidentatis.

Hab. Nagasaki, Japan, *Oldham.*

Very nearly resembling *C. argutus*, but with the leaves as in *C. Zippelianus*, Gottsche. They are, however, more rigid, and unaltered when dry.

CALYPOGEIA, *Raddi.*

C. BIDENTULA, *Nees ab E.*

Hab. Intermixed with the preceding, *Oldham.*

RADULA, *Nees ab E.*

R. PHYSOLOBA, *Mont.*

Hab. Rocks, Nagasaki, Japan, *Oldham.*

LEJEUNIA, *Gottsche et Ldbg.*

L. SERPYLLIFOLIA, *Lib.*

Hab. Creeping amongst various mosses, Nagasaki, Japan, *Oldham.*

PELLIA, *Raddi.*

P. CALYCINA, *Tayl.*

Hab. Nagasaki, Japan, *Oldham.*

REBOULIA, *Raddi.*

R. HEMISPHÆRICA, *Raddi.*
Hab. Nagasaki, Japan, *Oldham*

MARCHANTIA, *L.*

M. NITIDA, *L. et L.*
Hab. Nagasaki, Japan, *Oldham.*

On Four New Genera of Plants of Western Tropical Africa, belonging to the Natural Orders *Anonaceæ, Olacineæ, Loganiaceæ,* and *Thymelæaceæ*; and on a New Species of *Paropsia.* By Professor OLIVER, F.R.S., F.L.S.

[Read May 5, 1864.]

[PLATE XII.]

IN a small parcel of well-selected and well-dried plants, collected at Old Calabar by the Rev. W. C. Thomson, recently forwarded to the Herbarium of the Royal Gardens at Kew through the kindness of Professor Balfour, I find many undescribed species, some of which are referable to new generic types.

Of four new genera included amongst these, and also of a remarkably fine new *Paropsia*, I have now the honour to lay brief descriptions before the Linnean Society. I have drawn up these descriptions partly from Mr. Thomson's specimens and partly from specimens previously sent to Kew from the same country by Mr. Gustav Mann.

PIPTOSTIGMA.

ANONACEARUM genus novum. Tribus *Mitrephoreæ.* Subtribus *Phæantheæ.*

CHAR. GEN.—*Sepala* tria, libera, ovata v. lanceolata, acuta. *Petala* sex, libera, biseriatim valvata; exteriora sepaloidea, sepalis longiora; interiora multo majora, tenera, plana v. marginibus reflexis, circa genitalia erecto-conniventia. *Stamina* indefinita, supra torum hemisphæricum dense imbricata; antheris sessilibus, cuneato-oblongis, extrorsis, connectivo apice truncato transverse rhomboidali. *Carpella* 4–6, apice in stigma sessile capitatum depresso-globosum obscure lobatum pilosum deciduum coalita; ovulis 6–10 in sutura uni- v. biseriatis. *Fructus* ignotus.—Arbores. *Folia* subsessilia, subparallele penninervia. *Racemi* cymosi simplices v. paniculæ, ad ramos annotinos v. vetustiores nascentes.

Plate XII. fig. 1. Genitalia and connivent bases of two petals. 2 & 3. Anther, front and back. 4. Gynœcium. 5 & 6. Vertical and transverse sections of an ovary.

1. P. PILOSUM, sp. nov. Foliis obovato-oblongis breviter apiculatis basi subcordatis, membranaceis subtus parce pilosis, racemis elongatis simplicibus v. furcatis, bracteis lineari-lanceolatis pedicellis æquilongis v. longioribus, petalis exterioribus lineari-lanceolatis v. lanceolatis.—Ramuli pilis ferrugineis molliter tomentosis. Folia 10–14 poll. longa, supra medium $5\frac{1}{2}$–$6\frac{1}{2}$ poll. lata, supra glabrescentia, subtus laxe pilosa, petiolo brevissimo nervoque medio sericeo-pilosis. Racemi (penduli?) 6 poll. ad 2 ped. longi, ferrugineo-pilosi, bracteis $\frac{1}{2}$ poll. longis. Flores pedicellati bracteis sæpe oppositi. Sepala ovato-lanceolata acuta extus pilosa, lin. longa. Petala exteriora anguste lanceolata, 6–8 lin. longa, interiora fragilia multo majora, exunguiculata, basi circa genitalia concaviuscula, extus sericeo-pilosa, intus plus minus pubescentia v. sparse tomentella, ad $1\frac{1}{2}$–2 poll. longa. Andrœcium globosum. Carpella 4–6 hirsuta, ovariis liberis, stigmatibus sessilibus, pilosis, coalitis; ovula circiter 8, uni- v. subbiseriata.

Hab. Old Calabar, *Rev. W. C. Thomson.*

Mr. Thomson describes the "calyx as externally light brown. Corolla very light pink, with deeper streaks.... Fruit of several united carpels; seeds in two rows, covered with a little pulp; bright scarlet."

2. P. GLABRESCENS, sp. nov. Foliis oblanceolato-oblongis breviter acuminatis, basi sæpius obtusis, glabris glabrescentibusve, paniculis cymose dichotomis, bracteis ovatis acutis, petalis exterioribus ovatis v. ovato-lanceolatis acutis.—Arbor 30-pedalis. Ramuli primum pilosi, annotini glabrescentes. Folia 4–8 poll. longa, supra medium $1\frac{1}{2}$–$2\frac{1}{2}$ poll. lata, basin versus sæpius leviter angustiora, pagina superiore glabra, inferiore glabrescente v. sparse pilosula, nervo medio atque venis secundariis pilosis exceptis. Paniculæ dichotomæ ad 10–12 poll. longæ, ramulis ultimis ferrugineo-pilosis, bracteis parvis pedicellis sæpius brevioribus. Flores nutantes. Sepala triangulari-ovata, acuta, adpresse pilosa, intus glabriuscula. Petala exteriora quam sepala fere duplo longiora, interiora multo majora, ad $\frac{3}{4}$–1 poll. longa, ovato-lanceolata v. oblonga, acuta, utrinque tomentosa v. extus, basin versus, adpresse pilosa. Carpella 4; ovulis 6–10 biseriatis.

Hab. Kongui River, East Tropical Africa, *Mr. Gustav Mann*, August and September 1862.

RHAPTOPETALUM.

OLACINEARUM genus novum. Tribus *Olaceæ.*

CHAR. GEN.—*Calyx* parvus cupulatus, margine subinteger v. dentato-lobulatus, fructifer immutatus. *Petala* tria perigyna ad marginem disci inserta, coriacea, glabra, æstivatione valvata. *Stamina* indefinita (30–40), filamentis brevibus in tubum ad basin petalorum adnatum coalitis, antheris elongatis anguste linearibus erectis, apicem versus rima longitudinali breviter dehiscentibus. *Ovarium* in discum leviter immersum, semiinferum, quadriloculare, dissepimentis ad apicem

attingentibus, stylo filiformi, stigmate minuto; ovula in quoque loculo ad 6, ab apice centrali pendula. *Fructus* ellipsoideus v. oblongus, pericarpio crustaceo v. sublignoso, unilocularis, monospermus. —Arbor glaberrima. *Folia* alterna integra coriacea. *Flores* pedicellati in fasciculos umbellulatos sæpius paucifloros dispositi.

Fig. 1. 1. Buds just before expansion, natural size. 2. Fruit. 3. Vertical section of flower. 4. Monadelphous stamens adnate to the petals. 5. Single stamen. 6. Transverse section of ovary.

1. R. CORIACEUM, sp. unica. Arbor 30-pedalis, ramulis teretibus lineis brevibus parum elevatis a basi foliorum decurrentibus utrinque notatis. Folia breviter petiolata elliptica v. ovato-elliptica, sæpe obtuse et breviter apiculata basi rotundata v. subacutata, utrinque glabra, $3\frac{1}{2}$–$5\frac{1}{2}$ poll. longa, $1\frac{1}{2}$–$2\frac{3}{4}$ poll. lata, petiolus 1–3 lin. longus. Flores sæpe paulo supraaxillares, pedicellis gracilibus, alabastra 3–4 lin. longa, ovoideo-oblonga, subacuta. Fructus (indehiscens, an subdrupaceus?) 9–10 lin. longus.

Hab. Fernando Po, *Mr. Gustav Mann*, 1862. Old Calabar, *Rev. W. C. Thomson*, who describes the corolla as pink and white.

LEPTOCLADUS.

LOGANIACEARUM genus novum.

CHAR. GEN.—*Calyx* persistens parvus 4–5-fidus. *Corolla* hypogyna, tubulari-infundibuliformis, limbi laciniis 4–5 brevibus, obtusis, æstivatione imbricatis. *Stamina* 4 v. 5 imo corollæ tubo inserta, inclusa; filamentis lineari-subulatis; antheris bilocularibus, loculis basi leviter divergentibus, longitudinaliter dehiscentibus. *Ovarium* biloculare; stylo filiformi; stigmate bifido, lobis bipartitis lineari-filiformibus, revolutis; ovulis in loculis geminatis adscendentibus collateralibus. *Fructus* (immaturus) coriaceus, compressus, late obcordatus v. bilobus, lobis subinæqualibus obtusis monospermis (an interdum dispermis?). *Semina* compressa lateribus pilosulis margine glabris (an maturitate subalatis?).—Frutex, ramulis strictis gracilibus. *Folia* opposita, integerrima, petiolata; stipulis interpetiolaribus minutis. *Flores* parvi in paniculas paucifloras axillares v. terminales dispositi; bracteolis obsoletis.

Fig. 1. Bud. 2. Corolla laid open. 3. Anther. 4. Pistil. 5, 6. Vertical and transverse sections of the ovary. 7. Fruit.

1. L. THOMSONI, sp. unica. Ramuli novelli puberuli. Folia lanceolata utrinque attenuata v. ovato-lanceolata, petiolata, obtusa v. obtusiuscula, minutissime mucronulata, glabra. Paniculæ gracile pedunculatæ, folio sæpe breviores v. interdum longiores.

Folia: lamina 8–15 lin. longa, 3–6 lin. lata, petiolo 1–$1\frac{1}{2}$ lin. longo. Flores 2–3 lin. longi.

Hab. Old Calabar, *Rev. W. C. Thomson*, who states that the corolla is yellow with a white limb. When dry the corolla is reddish.

This interesting addition to the anomalous group of the Loganiaceæ presents, in the bifid lobes of the stigma, the same peculiarity in the Order as the genus *Gelsemium*, from which, however, it widely differs in its definite ovules and fruit.

Technically, I presume it must be, for the present, disposed under Mr. Bentham's tribe Gaertnereæ, characterized by solitary or geminate ovules. It is, however, very different in habit from any genus of this group known to me.

Octolepis.

Thymelæacearum genus novum.

Char. Gen.—*Perianthium* quadripartitum, loborum marginibus æstivatione imbricatis. Squamæ 8 per paria lobis perianthii oppositæ, integræ, æstivatione valvatæ. *Stamina* 8 fere hypogyna squamis alterna; filamentis liberis subulatis; antheris parvis ovatis v. ovato-cordatis, bilocularibus, longitudinaliter dehiscentibus. *Ovarium* superum, sessile, ovoideum, quadriloculare; stylo brevi, terminali; stigmate parvo, papilloso-dilatato; ovula in loculis solitaria pendula. *Fructus* ignotus.—Arbor parva. *Folia* alterna. *Flores* axillares, albi.

Fig. 1. Flower, natural size. 2. Vertical section of flower. 3. Stamen. 4. Scale. 5. Pistil. 6. Transverse section of an ovary.

1. O. Casearia, sp. unica. Frutex 6–8-pedalis. Ramuli juniores pubescentes v. puberuli, deinde glabrescentes. Folia breviter petiolata obovato-lanceolata, breviter acuminata v. apiculata, integra v. obscure repando-denticulata, membranacea, glabra, lamina $4\frac{1}{2}$–$9\frac{1}{2}$ poll. longa, $2\frac{1}{2}$–$3\frac{3}{4}$ poll. lata, petiolus 1–3 lin. longus. Flores in fasciculos paucifloros (3–4) dispositi, pedicellis gracilibus 2–3 lin. longis. Alabastra ovata, pedicellis æquilonga v. breviora. Perianthium lobis oblongo-ovatis obtusis v. obtusiusculis, extus pubescentibus, intus puberulis. Squamæ quadrato-oblongæ marginibus intus apicemque versus pilosæ, basin prope perianthii insertæ. Stamina filamentis basi pilosis. Ovarium dense pilosum, stylus brevis.

Hab. River Kongui, *Mr. Gustav Mann,* September 1862 and February 1863; Old Calabar, *Rev. W. C. Thomson.*

Octolepis is so far removed in floral structure from any other Thymelæaceous genus with which I am acquainted, that I am at a loss to know what are its nearest affinities. With its quadripartite perianth, squamæ, and four-celled ovary, it does not consort well with any described Aquilarineæ. In *Geissoloma* and the Cape group of Penæaceæ we find an approach to the structure of the pistil of *Octolepis*, but their habit is extremely diverse, and their perianth is usually, if not always, more or less deeply tubular.

Paropsia Guineensis, sp. nov. Ramulis ferrugineo-pubescentibus. foliis late ovalibus v. ellipticis, obtusiuscule acuminatis, repando-den-

tatis, breviter petiolatis, primum præcipue ad venulas pilosulis, denique supra glabrescentibus, racemis præcocibus multifloris erectis apicem versus ramulorum confertis, bracteis minutis ovatis caducis, floribus pedicellatis 3–4-fasciculatis, petalis membranaceis calyce longioribus, ovario glabro.

Hab. Old Calabar, collected by the *Rev. W. C. Thomson.*

But two species of this genus were previously known, viz. *P. Malayana* and *P. Madagascariensis*, natives respectively of the Malayan peninsula and of Madagascar. *P. Guineensis* forms, therefore, an interesting addition to the few congeneric representatives in West Tropical Africa of purely Malayan or of Malayan and at the same time Madagascar or Ceylon species. This new *Paropsia* differs remarkably in habit from its congeners in its precocious flowers, which are arranged in leafless racemes crowded towards the ends of the branches instead of in the axils of the leaves. The flowers, however, are fascicled in the axils of minute caducous bracts. Excepting in the more membranous and glabrous petals and glabrous ovary, I do not remark any important difference in the flowers of *P. Guineensis*, unless it be a tendency of the ovules to develope towards the upper part, or above the middle, of the placentary lines of the ovary instead of below the middle, or towards the base of the cavity.

On the Individual Sterility and Cross-Impregnation of certain Species of *Oncidium*. By Mr. John Scott, of the Royal Botanic Gardens, Edinburgh. Communicated by C. Darwin, Esq., F.R.S. & L.S.

[Read June 2, 1864.]

The writings of Kölreuter, Gärtner, and others furnish us with several illustrations of hermaphrodite plants whose two sexual elements are so modified in their action on each other that they are utterly sterile; the individual goodness of both the male and female elements being nevertheless shown by their facility in uniting with other individuals of the same species or with distinct species. With the view of further illustrating these singular phenomena, I, at the suggestion of Mr. Darwin, commenced a series of experiments, in repetition of those made by previous observers, as well as original experiments on distinct subjects. I have already communicated a few of these to the Botanic Society of Edinburgh (*vide* 'Proceedings,' 1863), of which, from their more or less immediate relation with the present notice, I will give a

brief preliminary abstract. The species experimented upon were the *Oncidium sphacelatum*, *O. altissimum*, *O. divaricatum* var. *cupreum*, *O. graminifolium*, and *O. ornithorhynchum*.

First, I impregnated six flowers of the *O. sphacelatum* with pollinia of the *O. divaricatum* var. *cupreum*, from which I obtained four fine plump capsules. These being in an immature state, when I made my communication to the Botanic Society of Edinburgh, I was unable to say anything respecting the condition of the seeds. Now, as I have examined the capsules, I may state that each was well filled with seeds, of which about one-fifth were embryonated.

Secondly, I applied the pollinia of *O. sphacelatum* to the stigmas of six flowers of the *O. graminifolium*, from which I obtained one good capsule with one-fourth of embryonated seeds. I failed to effect a reciprocal cross by applying pollinia from *O. graminifolium* to the stigmas of *O. sphacelatum*, as all the flowers thus operated upon dropped early.

Thirdly, I applied the pollinia of *O. sphacelatum* to the stigmas of *O. ornithorhynchum*, and from four flowers thus impregnated I obtained one capsule. On dissection I was disappointed by finding that it contained few seeds, and of these a very high percentage presented merely a loose transparent testa, entirely destitute of an embryo. I did not succeed in impregnating *O. sphacelatum* by pollinia of *O. ornithorhynchum*, though the capsules thus treated in several instances showed symptoms of swelling.

Fourthly, I tried repeatedly to fertilize *O. sphacelatum* with the pollinia of *O. altissimum*, and also to reciprocally fertilize *O. altissimum* by pollinia of *O. sphacelatum*, yet in both cases I utterly failed. It is here worthy of remark, as showing how completely independent the conjunctive capacity of two distinct species may be of their systematic affinities, that the *O. altissimum* and *O. sphacelatum*, which I have thus failed to cross, are nevertheless so closely allied as to have been regarded as conspecific, whereas in the previously given fertile unions of *O. sphacelatum* with *O. divaricatum* var. *cupreum*, *O. graminifolium*, and *O. ornithorhynchum*, there are great dissimilarities in the specific characters.

Fifthly, I impregnated a number of flowers on different plants of the *O. sphacelatum* with their own pollinia, yet in no instance did a single capsule swell. The only external signs the flowers afforded of being affected by the pollinia were the closing of the stigmatic orifice, twenty-four hours or so after their application, and the slightly earlier withering of the flowers. On the plant of *O. sphacelatum*, previously noticed as readily susceptible to fertilization by

the pollinia of *O. divaricatum cupreum*, I fertilized upwards of 200 flowers with own pollinia, yet every capsule proved abortive. That this inveterate abortion of the capsules was neither due to the non-emission nor to the non-penetration of the pollen-tubes, I satisfied myself by the dissection and examination of the columns of many of these flowers as they dropped off, and in all I invariably found an abundance of pollen-tubes.

Such then is a brief abstract of the experiments illustrative of the peculiarities in the reproductive economy of certain species of *Oncidium*, as communicated to the Botanic Society of Edinburgh, and I will now proceed to give in fuller detail a series of experiments which I have lately made on the above and other species of *Oncidium* in the Royal Botanic Gardens of Edinburgh, as further illustrating the capriciousness of their relations in respect to fertility. Those which I have now to record were performed upon two perfectly self-sterile plants of *O. microchilum*—respectively given in the sequel as Nos. 1 and 2—and plants of the *O. ornithorhynchum* and *O. divaricatum cupreum*; they are as follows:—

First, I inserted pollinia of *O. microchilum* (No. 2) into the stigmatic chamber of eight flowers of the *O. ornithorhynchum*; of these, three produced capsules containing about 21 per cent. of good seed. I also tried the converse experiment, and applied pollinia from the *O. ornithorhynchum* to the stigmatic chambers of twelve flowers of the *O. microchilum* (No. 2), but in this case I failed in causing a single capsule to swell. To satisfy myself that this abortion of the capsules was not simply due to the non-development of the pollen-tubes, I dissected the columns of many of the flowers, and found in each an abundance of pollen-tubes.

Secondly, I inserted pollinia from the *O. microchilum* (No. 1) into the stigmatic chambers of eight flowers of the *O. ornithorhynchum*, and obtained five capsules. Of these one was perfectly developed, but yielded no good seed; the others, however, were well developed, and yielded about 16 per cent. of good seed. I tried the converse experiment likewise, and applied pollinia from the *O. ornithorhynchum* to the stigmatic chambers of twelve flowers of the *O. microchilum* (No. 1), yet I failed to obtain a single good capsule, though I had hopes, from the early development of two of them, that the results would have been otherwise; both dropped prematurely, although on dissection of the columns of several of the flowers I found an abundance of pollen-tubes. As shown, however, the pollinia of the *O. ornithorhynchum* in the present as in the above case, though thus absolutely ineffective in the fertilization of *O. microchilum* (No. 1), are nevertheless good,

as I have proved by their application to their own stigmas as well as to those of *O. pumile*, fertile unions having in several instances been thus effected.

Thirdly, I inserted pollinia of *O. microchilum* (No. 2) into the stigmatic chambers of six flowers of the *O. divaricatum cupreum*, and obtained three capsules, which yielded about 36 per cent. of good seed. I likewise tried the converse experiment, and applied pollinia of the *O. divaricatum cupreum* to the stigmas of six flowers of the *O. microchilum* (No. 2), yet though two of these produced capsules, I could not, after a most careful examination of their contents, detect an embryonated seed. I repeated this experiment on twelve other flowers with even less success than before, as every capsule aborted.

Fourthly, I inserted pollinia of *O. microchilum* (No. 1) into the stigmatic chambers of six flowers of *O. divaricatum cupreum*, and obtained four capsules, which contained about 34 per cent. of good seed. By the converse experiment I had, from six flowers of the *O. microchilum* (No. 1), impregnated by pollinia of *O. divaricatum cupreum*, two capsules, which yielded 42 per cent. of good seed.

Fifthly, I inserted pollinia of *O. microchilum* (No. 2) into the stigmatic chambers of six flowers of the *O. microchilum* (No. 1), and obtained five capsules, of which four were good, yielding about 75 per cent. of embryonated seeds. I also tried the converse experiment, and applied pollinia (known to be good from their action on other species) of *O. microchilum* (No. 1) to the stigmas of six flowers of *O. microchilum* (No. 2), but in this case every capsule aborted. Struck with the great difference in the results of these reciprocal crosses, I repeated the last experiment, and impregnated in the same manner twelve other flowers of the *O. microchilum* (No. 1), but the result was similar, all the flowers proving abortive.

Sixthly, I impregnated twelve flowers of *O. microchilum* (No. 1) by its own pollen, yet not one produced a capsule. I repeated this experiment on twelve other flowers with the same result. The insusceptibility of this plant to fertilization by its own pollen interested me, so that I again and again repeated the experiment, but the foregoing results were repeated, not one capsule ever having set. I may state that on dissection of the columns of a number of these flowers, I invariably found them abundantly permeated by the pollen-tubes.

Seventhly, I impregnated twelve flowers of *O. microchilum* (No. 2) by its own pollen; nevertheless, though in this instance again pollen-tubes were freely developed, they failed in effecting

a fertilizing influence: not one capsule swelled. By a repetition of this experiment on twelve flowers, I had nearly the same results, one flower alone producing a capsule; but this dropped off prematurely and contained no embryonated seeds. From this indication, however, of a certain degree of susceptibility in this plant to its own pollinic influence, I repeated the above experiment on a vast number of flowers, but the result in all was the same; and I observed in no single instance even the slightest symptom of a capsule swelling.

For the sake of clearness I will here give, in a tabulated form, the results of the above experiments, thus:—

Unions between *Oncidium microchilum*, *O. divaricatum* var. *cupreum*, and *O. ornithorhynchum*.

	Number of flowers fertilized.	Total number of capsules produced.	Number of good capsules.	Estimated total number of seeds produced.	Estimated number of good seeds.	By calculation. Total seeds. Good seeds.
1. *O. ornithorhynchum* by pollinia of *O. microchilum* (No. 2)	8	3	3	20,200	4,242	or as 1000 to 210
2. *O. microchilum* (No. 2) by pollinia of *O. ornithorhynchum*	12	0				
3. *O. ornithorhynchum* by pollinia of *O. microchilum* (No. 1)	8	5	4	23,360	3,737	or as 1000 to 160
4. *O. microchilum* (No. 1) by pollinia of *O. ornithorhynchum*	12	2	0			
5. *O. divaricatum cupreum* by pollinia of *O. microchilum* (No. 2) ...	6	3	3	22,050	7,938	or as 1000 to 360
6. *O. microchilum* (No. 2) by pollinia of *O. divaricatum cupreum* ...	18	2	0			
7. *O. divaricatum cupreum* by pollinia of *O. microchilum* (No. 1) ...	6	4	4	26,240	8,922	or as 1000 to 340
8. *O. microchilum* (No. 1) by pollinia of *O. divaricatum cupreum* ...	6	2	2	17,700	7,434	or as 1000 to 420
9. *O. microchilum* (No. 1) by pollinia of *O. microchilum* (No. 2) ...	6	5	4	45,800	34,350	or as 1000 to 750
10. *O. microchilum* (No. 2) by pollinia of *O. microchilum* (No. 1) ...	18	0				
11. *O. microchilum* (No. 1) by own pollen.........	24	1	0			
12. *O. microchilum* (No. 2) by own pollen.........	24	0				

In the first four columns of the above Table the number of flowers fertilized and the total number of capsules and seeds produced are shown; in the fifth column I have given, by a careful microscopic examination in each case of 1000 seeds, the relative number of embryonated seeds produced; and lastly, in the column at the right hand, for facility of comparison, the exact number of good seeds produced per 1000 of the total product is given.

By a summary comparison of these results we have the following highly interesting facts disclosed. First, we see that the male element of *O. microchilum* (No. 1) will fertilize the female element of the two distinct species, *O. ornithorhynchum* and *O. divaricatum cupreum*, and yet be completely impotent upon its own female element; nevertheless the susceptibility of the latter (female element) to fertilization is shown by its fertile unions with another individual of the same species, and likewise by a fertile union with an individual of a distinct species, namely, *O. divaricatum cupreum*. Secondly, the male element of *O. microchilum* (No. 2) will fertilize the female element of *O. ornithorhynchum* and *O. divaricatum cupreum*, and likewise another individual of its own species, though on its own female element it is utterly ineffective.

On a New Genus of *Moraceæ*, from Sumatra and Singapore. By Mr. Salpiz Kurz, Curator of the Herbarium of the Botanic Gardens, Calcutta. With a Note by Dr. Anderson. Communicated by T. Anderson, M.D., F.L.S.

[Read June 2, 1864.]

[Plate XIII.]

The plant, of which a generic diagnosis and a specific description are appended by Mr. Kurz, the newly appointed Curator of the Herbarium of the Calcutta Botanic Gardens, is an imperfectly described species, which yields some of the valuable timber known as Iron-wood in the Dutch East Indian Possessions.

Messrs. Teijsmann and Binnendyk, in describing another tree, *Eusideroxylon Zwageri*, T. et B., which produces Iron-wood (*vide* Tydschrift voor Nederl. Indie, 1863), enumerate the species known to them to afford the same class of timber. These are, *Eusideroxylon Zwageri*, T. et B.; *Namia vera*, Miq.; *Intsia Amboinensis*, Thouars; *Cassia florida*, Vahl; *Memecylon ferreum*, Blume; *Stadmannia Sideroxylon*, DC.; *Dodonæa Waitziana*,

Blume; and *Sloetia Sideroxylon*, T. et B. The last of these, *Sloetia Sideroxylon*, has received no further notice from Teijsmann and Binnendyk, that I can find, beyond this indication of the name. Its history is interesting. In the first place, it is the *Artocarpus elongatus*, Miq., in the Supplement to the 'Flora Indiæ Batavæ,' p. 419, a species described from specimens sent by Mr. Teijsmann from Sumatra. Living specimens were also taken by Mr. Teijsmann to the Botanic Garden, Buitenzorg, where they have grown to the height of 25 or 30 feet. They have produced flowers, from which Mr. Kurz has drawn up the generic description. I have found this species also at Singapore, in a few of the dense forests that still exist on the island; and specimens in flower, and immature fruit, are in the Herbarium of the Calcutta Botanic Garden.

Mr. Kurz was enabled to identify the plant with Professor Miquel's *Artocarpus elongatus* (*vide supra et infra*) by a set of Mr. Teijsmann's Sumatran collections having been kept in the Herbarium of the Buitenzorg Botanic Garden, while a set, correspondingly numbered, was sent to Utrecht. The specimen of this species sent to Professor Miquel probably contained no female flowers. If ovaries had been present, they would have attracted his notice, and shown the generic distinctness of the plant from *Artocarpus*.

T. ANDERSON.

Botanic Garden, Calcutta,
April 6, 1864.

SLOETIA, *Teijsm. et Binnend.*, absque descriptione.

Flores monoici, peltato-bracteolati, amentacei. *Masc.* Perigonium 3-lobum, æstivatione valvatum; stamina 3; pistilli rudimentum nullum; filamenta incumbentia, elastice exsilientia. *Fœm.* Perigonium 4-fidum; laciniæ biseriales, interiores exterioribus paulo minores; ovarium sessile, ovulo pendulo parieti styligero affixo; stylus subterminalis, breviusculus; stigmata 2, longissima, pubera. Achænium perigonio paulo indurescente inclusum, dein elastice ejectum.

Genus novum Artocarpearum prope *Toxotrophin* est inserendum.

SLOETIA SIDEROXYLON, *T. et B. in Tydschr. Nat. Ver.* 1863 (nomen solum).

Arbor vasta (in Hort. Bot. nunc 25-pedalis), lactescens, trunco ramisque cinerascentibus, ligno duro, ramulis divergentibus teretibus glabris viridibus. Innovationes puberes, cito glabrescentes. Stipulæ lineari-lanceolatæ, acuminatæ, membranaceæ, glabræ, deciduæ. Folia chartacea, alterna, breviter petiolata, e basi acuta v. subcuneata oblongo- v. elliptico-lanceolata, breviuscule acuminata, passim inæquilatera,

integra, glabra, supra lucida; nervi laterales 12–15 utrinque costaque utraque pagina prominuli; petiolus usque pollicem fere longus, teres, glaber. Amenta axillaria, geminata, rarius abortu solitaria, breviter ($\frac{1}{3}$ poll.) pedunculata, subtus nuda, supra floribus masculis densissime obducta, fœmineis paucis multo majoribus intermixtis. Bracteolæ trigono-peltatæ, minutæ, pilosulæ, ciliolatæ, virides. Flores sessiles, compacti, viridiusculi, dein albescentes. Sepala florum masc. basi in tubum brevem connata, extus pilosula, ea flor. fœm. libera, exteriora pubera, dein hirtella, interiora lævia, teneriora. Achænium pisi majoris magnitudine, stylo persistente auctum, perigonio hirtello inclusum, maturescens contactu etiam levi elastice (ad 6 metr.) exsiliens.

In sylvis Sumatræ; in prov. Palembang; in prov. Padang prope Lumut et ad littora prope Siboga, *Teijsmann*. Ins. Singapora, *T. Anderson, M.D.*

Nom. vernac. Kapinie.

Synon. Artocarpus elongatus, *Miq. Fl. Ind. Bat. Suppl.* p. 172 et 419.

TAB. XIII. fig. 1. Ramus floriferus magnit. nat.; fig. 2. Flos ♂ et ♀ auct. ut fig. sequent.; fig. 3. Sepalum exter. fl. ♀ a dorso; fig. 4. Sepal. inter. fl. ♀; fig. 5. Ovarium; fig. 6. idem, verticaliter transsect.; fig. 7. Semen, tegmento remoto.

On the Sexual Relations of the Three Forms of *Lythrum salicaria*.

By CHARLES DARWIN, F.R.S., F.L.S., &c.

[Read June 16, 1864.]

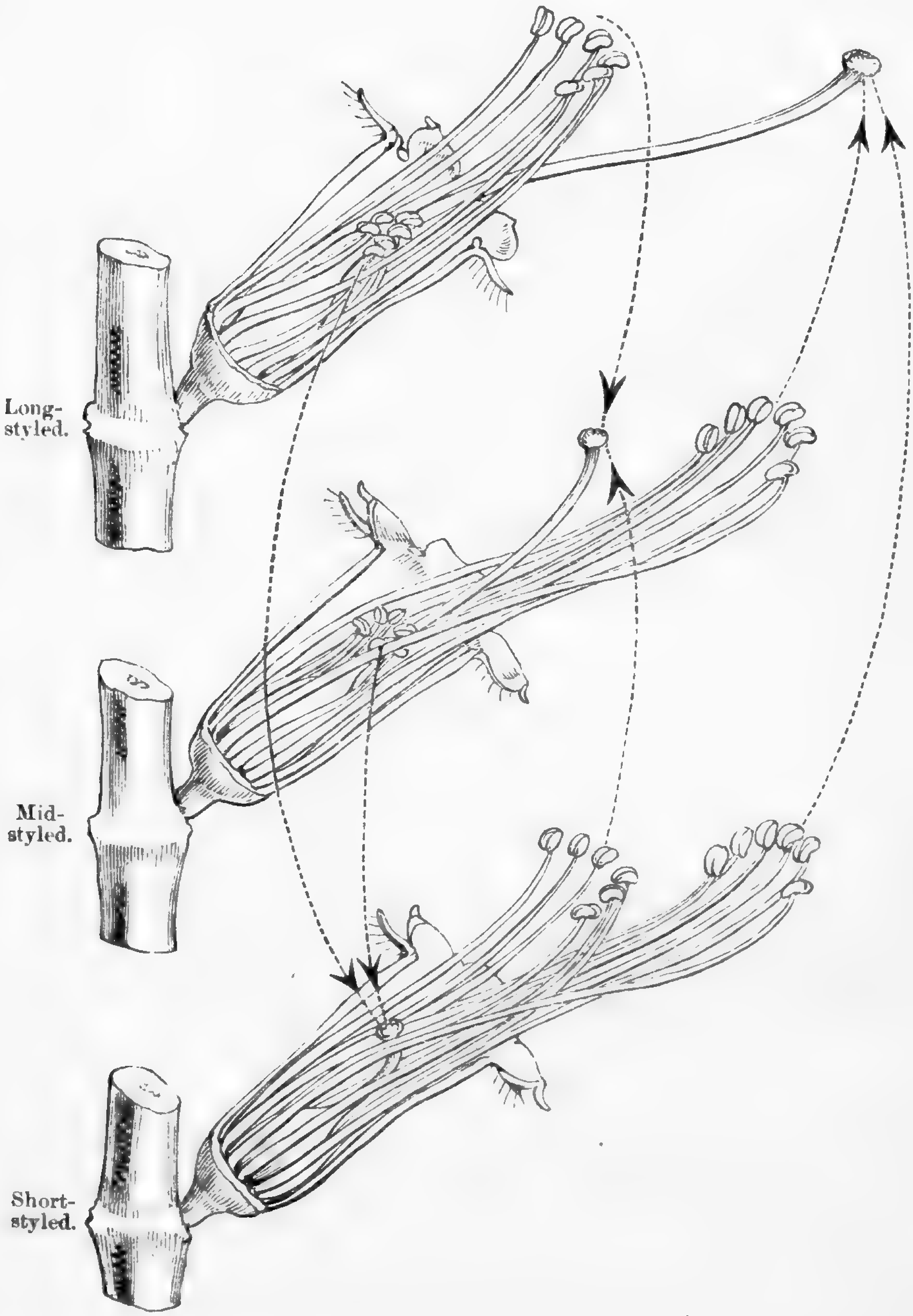
SOME of the species of *Lythrum* offer in their manner of fertilization a more remarkable case than can, perhaps, be found in any other plant or animal. In *Lythrum salicaria* three plainly different forms occur: each of these is an hermaphrodite, each is distinct in its female organs from the other two forms, and each is furnished with two sets of stamens or males differing from each other in appearance and function. Altogether there are three females and three sets of males, all as distinct from each other as if they belonged to different species; and if smaller functional differences are considered, there are five distinct sets of males. Two of the three hermaphrodites must coexist, and the pollen be carried by insects reciprocally from one to the other, in order that either of the two should be fully fertile; but unless all three forms coexist, there will be waste of two sets of stamens, and the organization of the species, as a whole, will be imperfect. On the other hand, when all three hermaphrodites coexist, and the pollen is carried from one to the other, the scheme is perfect; there is no waste of pollen and no false co-adaptation. In short, nature has ordained a most complex marriage-arrangement, namely a triple union between three hermaprodites,—each her-

maphrodite being in its female organ quite distinct from the other two hermaphrodites and partially distinct in its male organs, and each furnished with two sets of males.

The three forms may be conveniently called, from the unequal lengths of their pistils, the *long-styled*, *mid-styled*, and *short-styled*. Their existence and differences were first observed by Vaucher*, and subsequently more carefully by Wirtgen; but, not being guided by any theory, neither author perceived some of the most curious points of difference. I will first briefly describe the three forms by the aid of the accompanying accurate diagram, which shows the flowers, six times magnified, in their natural position, with their petals and the near side of the calyx removed.

Long-styled form.—This can at once be recognized by the length of the pistil, which is (including the ovarium) fully one-third longer than that of the mid-styled, and more than thrice as long as that of the short-styled form. It is so disproportionately long, compared with the flower, that it projects in the bud through the unfolded petals. It stands out considerably beyond the longer stamens; its terminal portion depends a little, but the stigma itself is slightly upturned: the globular stigma is considerably larger than that of the other two forms. The six longer stamens project about two-thirds of the length of the pistil, and correspond in length with the pistil of the mid-styled form. The correspondence with the pistil in length in this and the two following cases is generally very close; the difference, where there is any, being usually in a slight excess of length in the stamens. The six shorter stamens (each of which alternates with a longer one) lie concealed within the calyx; their ends are upturned, and they are graduated in length, so as to form a triple row—both which characters are here much more marked than with the longer stamens, which vary in these respects. The anthers of the shorter stamens are smaller than those of the longer stamens. Knowing that the pollen differs greatly in the longer and shorter stamens of the two other forms, I carefully compared that of the two sets of stamens in this form: in both the pollen-grains are yellow, but they are a little larger in the longer than in the shorter stamens. The difference is slight, so that I convinced myself of its reality only by putting two small heaps close together under the compound mi-

* Hist. Phys. des Plantes d'Europe, tom. ii., 1841, p. 371. Wirtgen, "Ueber *Lythrum salicaria* und dessen Formen," Verhand. des naturhist. Vereins der preuss. Rheinl., 5. Jahrgang, 1848, S. 7.



Diagrams of the flowers of the three forms of *Lythrum salicaria*, in their natural position, with the petals removed and with the near side of the calyx cut away: enlarged six times.

The dotted lines with the arrows show which pollen must be applied to each stigma to cause full fertility.

croscope, and I found I could always (with one exception) distinguish them: I then showed the specimens to two other persons, and they likewise distinguished the two kinds and pointed out which was the largest. The capsules of this form contain, on an average, 93 seeds: how this average was obtained will presently be explained. I repeatedly observed that the seed, when cleaned, seemed larger than that from the mid-styled or short-styled forms; consequently I placed 100 long-styled seeds in a good balance, and by the double method of weighing found that they equalled 121 seeds of the mid-styled and 142 of the short-styled; or, in short, that five long-styled seeds equalled six mid-styled and seven short-styled seeds. These slight differences in the weight of the seed, and, as we shall soon see, in the average number produced, are worth recording, as they characterize not mere varieties but coexisting forms of the same species.

Mid-styled form.—The pistil occupies the position represented in the diagram, with its extremity considerably, but in a variable degree, upturned; the stigma is seated between the anthers of the long and the short stamens. The six longer stamens correspond in length with the pistil of the long-styled form; their filaments are coloured bright pink; the anthers are dark-coloured, but from containing bright green pollen and from their early dehiscence they appear emerald-green. Hence the general appearance of these stamens is remarkably dissimilar from that of the longer stamens of the long-styled form. The six shorter stamens, enclosed within the calyx, resemble in all respects the shorter stamens of the long-styled form, and both correspond in length with the short pistil of the short-styled form. The green pollen-grains of the longer stamens are plainly larger than the yellow pollen-grains of the shorter anthers: this fact was conspicuous in several camera-lucida drawings made for me by my son, Mr. W. E. Darwin. There is some variability in size, but $\frac{12}{7000}$ of an inch may be taken as about the average diameter of the green pollen-grains when distended with water, and $\frac{9}{7000}$ as the diameter of the yellow grains of the shorter stamens; so that the difference in diameter is in about the proportion of four to three. The capsules contain, on an average, 132 seeds; but, perhaps, as we shall see, this is rather too high an average. The seeds themselves are smaller than those of the long-styled form.

Short-styled form.—The pistil is here very short, not one-third of the length of that of the long-styled form. It is enclosed within the calyx, which, differently from in the other two forms,

does not enclose any anthers. The end of the pistil is generally bent upwards at right angles. The six longer stamens, with their pink filaments and green pollen, resemble in size of the grains and in all respects the longer stamens of the mid-styled form, and both correspond in length with the long-styled pistil. The six shorter stamens, with their uncoloured filaments and yellow pollen, resemble in size of the grains and in all respects the longer stamens of the long-styled form, and both correspond in length with the mid-styled pistil. The capsules contain fewer seeds on an average than in either of the preceding forms, namely 83·5, and they are considerably smaller in size. In this latter respect, but not in number, there is a gradation parallel to that of the length of the pistil, the long-styled having the largest, the mid-styled the next in size, and the short-styled the smallest seed.

From this description we see that there are three distinct female organs, or rather females as they are borne on distinct individuals, differing in the length and curvature of the style, in the size of the stigma, and in the number and size of the seed. In the three forms, taken together, there are thirty-six stamens or males, and these can be divided into three sets of a dozen each, differing from each other in length, curvature, and colour of the filaments, in the size of the anthers, and especially in the colour and diameter of the pollen-grains. Each of the three forms bears half-a-dozen of one kind of stamens and half-a-dozen of another kind, but not all three kinds. The three kinds correspond in length with the three pistils: the correspondence is always between half the stamens borne by two forms with the pistil of a third form. These remarks apply to the structure, and not, as yet, to the functions, of the reproductive organs.

I ascertained the average number of seed by counting them in eight fine selected capsules taken from plants of the three forms growing wild, and the result was, as we have seen, for the long-styled (neglecting decimals) 93, mid-styled 132, and short-styled 83. I should not have trusted this result, but I had a number of plants in my garden which, from their youth, did not yield the full complement of seed, but they were of exactly the same age and grew under exactly the same conditions, and were freely visited by bees. I took six fine capsules from each, and found the average to be for the long-styled 80, for the mid-styled 97, and for the short-styled 61. Lastly, I made numerous artificial unions, and, as may be seen in the following Tables, these gave in the long-styled an average of 90 seeds, in the mid-styled 117,

and in the short-styled 71. So that we have good concurrent evidence of the different average production of seed by the three forms. To show that the artificial fertilizations, presently to be described, produced their full effect and may be trusted, I may state that one mid-styled capsule yielded 151 good seeds, which is the exact number of the finest wild capsule examined by me. Artificially fertilized short- and long-styled capsules actually produced a greater number of seeds than I have found in wild plants, but then I did not examine many of the latter. This Lythrum, I may add, offers a remarkable instance, how profoundly ignorant we are of the life-conditions of each species: naturally it grows "in wet ditches, watery places, and especially on the banks of streams," and though it produces so many minute seeds, it never spreads on the adjoining land; yet, planted in my garden, on clayey soil lying over the chalk, and which is so dry that a rush cannot be found, it thrives luxuriantly, grows to above six feet in height, produces self-sown seedlings, and (which is a severer test) is fully as fertile as in a state of nature. Nevertheless it would be almost a miracle to find this plant spontaneously growing on such land as my garden, though under its native climate.

According to Vaucher and Wirtgen, the three forms coexist in all parts of Europe. Some friends gathered for me in North Wales a number of twigs from separate plants growing near each other, and then classified them. My son did the same in Hampshire, and here is the result:—

	Long-styled.	Mid-styled.	Short-styled.	Total.
North Wales	95	97	72	264
Hampshire .	53	38	38	129
Total. . . .	148	135	110	393

If twice or thrice the number had been collected, probably the three forms would have been found nearly equal; I infer this from considering the above figures, and from my son telling me that if he had collected in another spot, he felt sure that the mid-styled plants would have been in excess. I several times sowed small parcels of seed, and raised all three forms; but I neglected to record the parent form, except in one instance, in which I raised from short-styled seed twelve plants, of which only one turned out long-styled, four mid-styled, and seven short-styled.

Insects are necessary for the fertilization of this Lythrum. During two years I kept two plants of each form protected, and in the autumn they presented a remarkable contrast in appearance with the adjoining uncovered plants, which were densely covered with capsules. In 1863 a protected long-styled plant produced only five poor capsules; two mid-styled plants produced the same number; and two short-styled plants between them produced only one: these capsules contained very few seed; yet the plants were fully productive when artificially fertilized under the net. In a state of nature the flowers are incessantly visited for their nectar by hive- and humble-bees and various Diptera. The nectar is secreted all round the base of the ovarium; but a passage is formed along the upper and inner side of the calyx by the lateral deflection (not represented in the diagram) of the basal portions of the filaments; so that insects invariably alight on the upper side of the flowers, on the projecting stamens and pistil, and insert their probosces along the upper inner margin of the calyx. We can now see why the ends of the stamens with their anthers, and the ends of the pistils with their stigma, are a little upturned, in order that they may brush against the lower hairy surfaces of the insects' bodies. The short stamens which lie enclosed within the calyx of the long- and mid-styled forms can be touched only by the proboscis and the narrow chin of the sucking bee; hence they have their ends more upturned, and they are graduated in length, so as to fall into a narrow file, three deep, sure to be raked by the thin intruding proboscis. The anthers of the longer stamens stand laterally further apart and are more nearly of the same length, for they have to brush against the whole breadth of the insect's body. I may here incidentally remark, that in very many flowers the pistil, or the stamens, or both, are rectangularly bent to one side of the flower: this bending may be permanent, as with *Lythrum* and many others, or may be effected (as in *Dictamnus fraxinella* and many others) by a temporary movement which occurs in the stamens when the anthers dehisce, and in the pistil when the stigma is mature; but these two movements are by no means always contemporaneous in the same flower. Now I have found no exception to the rule, that when the stamens and pistil are bent, the bending is exactly to that side of the flower which secretes nectar (even though there be a rudimentary nectary of large size on the opposite side, as in some species of *Corydalis*); or, when nectar is secreted on all

sides, to that side where the structure of the flowers allows the easiest access to it, as in *Lythrum*, Papilionaceous flowers, and many others. The rule consequently is that when the pistil and stamens are bent, the stigma and anthers are brought into the pathway towards the nectary. There are a few cases which seem to be exceptions, but they are not so in truth: for instance, in the Gloriosa lily, the stigma of the grotesque and rectangularly bent pistil is brought, not into the pathway from the open air towards the nectar-secreting recesses of the flower, but into the circular route from one nectary to the other; in *Scrophularia aquatica* the pistil is bent downwards from the mouth of the flower, but it thus strikes the pollen-dusted breasts of the wasps which habitually visit these ill-scented blooms. In the above rule we see one more instance of the supreme dominating power of insects over all the minor structural details of flowers, especially of those which have irregular corollas. Flowers which are fertilized by the wind must of course be excepted, but I do not know of a single instance of an irregular flower which is fertilized or crossed by this means.

I have delayed too long on these points, but I must allude to one other. We have seen that the three pistils of different lengths have each two half-dozen sets of stamens of corresponding length. When bees suck the flowers, the longest stamens, bearing the green pollen, rub against the abdomen and the interior sides of the posterior legs, as does likewise the stigma of the long-styled form. The stamens of middle length and the stigma of the mid-styled form rub against the under side of the thorax and between the front pair of legs. The shortest stamens and the stigma of the short-styled form must rub against the proboscis and chin; for the bees in sucking insert only the front of their heads into the calyx. On catching bees, I observed much green pollen on the inner sides of the hind legs and on the abdomen, and much yellow pollen on the under side of the thorax. There was also pollen on the chin, and, it may be presumed, on the proboscis, but this was difficult to observe. I had, however, independent proof that pollen is carried on the proboscis; for in a protected short-styled plant (which produced only two capsules) one small branch was accidentally left during many days pressing against the fine net, and bees were seen inserting their probosces through the meshes, and in consequence numerous capsules were formed on this one small branch. From these several facts it follows that insects would chiefly carry to the

stigma of each form pollen from the stamens of corresponding length; and we shall presently see the importance of this adaptation. It must not, however, be supposed that the bees do not get more or less dusted all over with the several kinds of pollen; they certainly do, as could be seen with the green pollen from the longest stamens. Moreover, a case will presently be given of a long-styled plant which grew absolutely by itself, and produced an abundance of capsules, which must have been fertilized by its own two kinds of pollen; but these capsules contained a very poor average of seed. Hence insects, and chiefly bees, act both as general carriers of pollen, and as special carriers of the right kind *.

Variability.—Before passing on to more important topics, I must say a few words on this head. Wirtgen remarks † on the variability in the branching of the stem, in the length of the bracteæ, size of the petals, and in several other respects. The plants now growing in my garden have their leaves arranged oppositely, alternately, and in whorls of three, and differ greatly in shape. The stems of the plants bearing leaves in whorls are hexagonal; those of the other plants are quadrangular. But we are concerned only with the reproductive organs: the upward bending of the pistil is variable, and in a remarkable degree in the short-styled form, in which it is sometimes straight, sometimes slightly curved, but generally upturned at right angles. The stigma of the long-styled pistil frequently has longer papillæ or is rougher than that of the mid-styled, and this than that of the short-styled form; but this character, though fixed and uniform with the two forms of *Primula*, is here variable, and I have

* In my paper on the two forms of *Primula* (Journal Proc. Linn. Soc. 1862, p. 85) I stated that I had only occasionally seen humble-bes sucking the flowers of the Cowslip (*P. veris*). Since then I have had some beds in my garden containing nearly 700 plants, and these were incessantly visited by *Bombus hortorum* and *B. muscorum*. I caught some of these bees, and I found (as I had anticipated in my paper, p. 86) that a vast majority of the pollen-grains which adhered to the base of the proboscis were large-sized and had come from the long stamens of the short-styled form, and were thus placed ready to fertilize the stigma of the long-styled form. On the other hand, on the middle, and near the tip of the proboscis, a very large proportion of the pollen-grains were of the small size, and had come from the short stamens of the long-styled form. My son caught, also, a moth (*Cucullia verbasci*) hovering over the bed, and I found on its proboscis a similar distribution of the two kinds of pollen-grains. I give these facts as a further illustration of the importance of the relative lengths of the stamens and pistil.

† Verhand. des naturhist. Vereins, 5. Jahrgang, 1848, S. 11, 13.

seen mid-styled stigmas rougher than those of the long-styled. The degree to which the longer and middle stamens are graduated in length and are upturned at their ends is variable; sometimes all are equal. The colour of the green pollen in the long stamens is variable *, and is sometimes pale greenish yellow; in one short-styled plant it was almost white. The grains vary a little in size: I examined one short-styled plant with the grains above the average size; and I have seen a long-styled plant with undistinguishable grains from the longer and shorter anthers. We have here considerable fluctuations of character; and if any of these slight structural differences were of direct service to the plant, or were correlated with useful functional differences, we can perceive that the species is just in that state in which natural selection might readily do much for its modification.

To return to our proper subject—we see that there are three kinds of females and three kinds of males, each kind of the latter being borne by half-dozens on two of the three forms. It remains to discover whether these several sexes or sexual organs differ from each other in function. Nothing brings more prominently forward the complexity of the reproductive system of this extraordinary plant, than the necessity, in order to ascertain the above fact, of artificially making eighteen distinct unions. Thus the long-styled form had to be fertilized with pollen from its own two distinct kinds of anthers, from the two in the mid-styled, and from the two in the short-styled form. The same process had to be repeated with both the mid- and short-styled forms. It might have been thought sufficient to have tried on each stigma the green pollen, for instance, from either the mid- or short-styled longer stamens, and not from both; but the result proves that this would have been insufficient, and that it was necessary to try all six kinds of pollen on each stigma. As in artificial fertilizations there will always be some failures, it would have been advisable to have

* *Lagerstrœmia Indica*, one of the Lythraceæ, is strangely variable in its stamens—I presume in part due to its growth in a hothouse. The most perfect flowers produced with me five very long stamens with thick flesh-coloured filaments and green pollen, and from nineteen to twenty-nine short stamens with yellow pollen; but many flowers produced only one, two, three, or four long stamens with green pollen, which in some of the anthers was wholly replaced by yellow pollen; one anther offered the singular case of half, or one cell being filled with bright green, and the other cell with bright yellow pollen. One petal had a furrow near its base, which contained pollen. According to analogy with *Lythrum*, this species would produce three forms; if so, the above plant was a mid-styled form: it was quite sterile with its own two kinds of pollen.

repeated each of the eighteen unions a score of times; but the labour would have been too great; as it was, I made 223 artificial unions; *i. e.*, I fertilized, on an average, above a dozen flowers in the eighteen different methods. Each flower was castrated; the adjoining buds had to be removed, that the marking-thread, wool, &c. might be safely secured; and after each fertilization the stigma had to be examined with a lens to see that there was sufficient pollen. Plants of all three forms were protected during two years by large nets on a framework; two plants were used during one or both years, in order to avoid any individual peculiarity in any one plant. As soon as the flowers withered, the nets were removed; and in the autumn the capsules were daily inspected; when the seeds were ripe they were counted under the microscope. I have given these details that confidence may be placed in the following Tables, and as some excuse for two blunders which, I believe, I made. These blunders are referred to, with their probable causes, in two notes to the Tables; the erroneous numbers, however, are entered in the Tables, that it may not be supposed that I have in any one instance tampered with the results.

A few words explanatory of the three Tables must be given. Each is devoted to one form, and is divided into six compartments. The two upper ones in each table give the product of good seed from the application of pollen from the two sets of stamens which correspond in length with the pistil of that form. The two next lower compartments show the result of pollen from the other two sets of stamens, which do not correspond in length with the pistil, and which are borne by the same two forms. The two lowest compartments show the result of the application of each form's own two kinds of pollen. The term "own pollen," used here and in the Tables, does not mean pollen from the flower to be fertilized —for this was never used—but from another flower on the same plant, or more commonly from a distinct plant of the same form. In the result given, "0" generally means that no capsule was produced, or that the capsule contained no good seed. In some part of each row of figures in each compartment, a short horizontal line may be seen; the unions above this line were made in 1862, and below it in 1863. It is of importance to observe this, as it shows that the same general result ensued in two successive years; but more especially because 1863 was a very hot and dry season, and the plants had occasionally to be watered. This did not prevent the full complement of seed being produced from

the more fertile unions; but it rendered the less fertile unions even more sterile than they otherwise would have been. I have seen striking instances of this same fact in making homomorphic and heteromorphic unions in *Primula* *; and it is well known that the conditions of life must be highly favourable to give any chance of producing hybrids from species which cross with difficulty.

Table I.—Long-styled Form.

I.		II.	
13 flowers fertilized by the longer stamens of the mid-styled. *These stamens equal in length the pistil of the long-styled.*		13 flowers fertilized by the longer stamens of the short-styled. *These stamens equal in length the pistil of the long-styled.*	
Product of good seed in each capsule.		Product of good seed in each capsule.	
36	53	159	104
81	0	43	119
0	0	96 poor seed.	96
0	0	103	99
0	0	0	131
—	0	0	116
45		—	
41		114	
38 per cent. of these flowers yielded capsules. Each capsule contained, on an average, 51·2 seed.		84 per cent. of these flowers yielded capsules. Each capsule contained, on an average, 107·3 seed.	

* In the spring of 1862 I crossed forty Cowslip flowers (*P. veris*) heteromorphically and homomorphically. The plants were accidentally exposed in the greenhouse to too hot a sun, and a number of umbels perished. Some, however, remained in moderately good health, and on these there were twelve flowers which had been fertilized heteromorphically and eleven which had been fertilized homomorphically. The twelve heteromorphic unions yielded seven fine capsules, containing on an average 57·3 good seed. Now mark the difference: the eleven homomorphic unions yielded only two capsules, of which one contained 39 seeds, but so poor, that I do not suppose one would have germinated, and the other only 17 fairly good seed. It would be superfluous to give any more details on this experiment, or on some which I made at the same time on *P. Sinensis*, after the appearance of Mr. John Scott's admirable paper on the various dimorphic species of *Primula*, in which he confirms my former results, and adds many original and valuable observations. Dr. Hildebrand has also (Botanische Zeitung, 1864, Jan. 1, S. 3) confirmed my general results with respect to *P. Sinensis*, and has corrected an error into which in some unaccountable manner I fell, namely, that the pollen-grains from the long- and short-styled forms were of the same size. Dr. Hildebrand has added a series of new and important experiments, for he fertilized homomorphically a number of flowers with pollen from the same form, and likewise from the same individual flower. These latter he found were thus rendered rather more sterile. This experiment, I believe, has never been systematically tried before.

Table I.—Long-styled Form (*continued*).

III.

14 flowers fertilized by the short stamens of the mid-styled.

3	0
0	0
0	0
0	0
0	0
—	0
0	0
0	

Too sterile for any average.

IV.

12 flowers fertilized by the shorter stamens of the short-styled.

20	0
0	0
0	0
0	0
—	0
0	0
0	

Too sterile for any average.

V.

15 flowers fertilized by *own* longer stamens.

2	—
10	0
23	0
0	0
0	0
0	0
0	0
0	0

Too sterile for any average.

VI.

15 flowers fertilized by *own* shorter stamens.

4	—
8	0
4	0
0	0
0	0
0	0
0	0
0	0

Too sterile for any average.

I fertilized a considerable number of flowers with pollen, taken by a camel's-hair brush, from both the long and short stamens of their own (long-styled) form; but I did not examine with a lens (as I did in the cases in the Tables) whether sufficient pollen had been placed on the stigma: only 5 capsules were produced, and these yielded on an average 14·5 seed. In 1863 I tried a much better experiment: a long-styled plant was grown by itself, miles away from any other plant, so that its stigmas could have received only the two kinds of pollen proper to this form. The flowers were incessantly visited by bees, so that the stigmas must have received on the most favourable days, and at the most favourable hours, successive applications of pollen: all who have crossed plants know that this highly favours fertilization. This plant produced an abundant crop of capsules; I took by chance 20, and these (excluding one poor one) contained seed as below:—

20	20	35	21	19
26	24	12	23	10
7	30	27	29	13
20	12	29	19	35

This gives an average of 21·5 seed per capsule; and as we know that this form, when standing near plants of the other two forms and fertilized by insects, produces an average of 93·1 seed per capsule, we see that the long-styled form fertilized by its own two pollens yields only between one-fourth and one-fifth of the full number of seed. I have spoken as if this plant had received both its own kinds of pollen, and this is, of course, possible; but, from the enclosed position of the shorter stamens, it is much more probable that the stigma received almost exclusively the pollen from its own longer stamens.

Table II.—Mid-styled Form.

I.

12 flowers fertilized by the longer stamens of the long-styled. *These stamens equal in length the pistil of the mid-styled.*

Product of good seed in each capsule.

138	122
149	50
147	151
109	119
133	138
144	0
—	

92 per cent. of the flowers (probably 100 per cent.) yielded capsules. Each capsule contained, on an average, 127·3 seed.

II.

12 flowers fertilized by the shorter stamens of the short-styled. *These stamens equal in length the pistil of the mid-styled.*

Product of good seed in each capsule.

112	109
130	143
143	124
100	145
33	12
—	141
104	

100 per cent. of the flowers yielded capsules. Each capsule contained, on an average, 108·0 seed; or, excluding capsules with less than 20 seed, the average is 116·7 seed.

III.

13 flowers fertilized by the short stamens of the long-styled.

83	12	
0	19	} seed small and poor.
0	85	} seed small and poor.
—	0	
44	0	
44	0	
45	0	

54 per cent. of the flowers yielded capsules. Each capsule contained, on an average, 47·4 seed; or, excluding capsules with less than 20 seed, the average is 60·2 seed.

IV.

15 flowers fertilized by the longer stamens of the short-styled.

130	86
115	113
14	29
6	17
2	113
9	79
—	128
132	0

93 per cent. of the flowers yielded capsules. Each capsule contained, on an average, 69·5 seed; or, excluding capsules with less than 20 seed, the average is 102·8.

V.

12 flowers fertilized by *own* longer stamens.

92	0
9	0
63	0
—	0
136 ?*	0
0	0
0	

Excluding the capsule with 136 seed, 25 per cent. of the flowers yielded capsules, and each capsule contained, on an average, 54·6 seed; or, excluding capsules with less than 20 seed, the average is 77·5.

VI.

12 flowers fertilized by *own* shorter stamens.

0	0
0	0
0	0
—	0
0	0
0	0
0	

0 per cent. of the flowers yielded capsules.

* I have hardly any doubt that this result of 136 seed is due to a gross error. The flowers to be fertilized by their own longer stamens were first marked by

I fertilized a considerable number of flowers with pollen, taken by a camel's-hair brush, from both the long and short stamens of their own (short-styled) form; but I did not examine with a lens (as I did in the cases in the Tables) whether sufficient pollen had been placed on the stigma: only 5 capsules were produced, and these yielded, on an average, 11·0 seed.

Table III.—SHORT-STYLED FORM.

<table>
<tr>
<td>I.
12 flowers fertilized by the shorter stamens of the long-styled. These stamens equal in length the pistil of the short-styled.
69   56
61   88
88   112
66   111
0   62
0   100
—
83 per cent. of the flowers yielded capsules. Each capsule contained, on an average, 81·3 seed.</td>
<td>II.
13 flowers fertilized by the shorter stamens of the mid-styled. These stamens equal in length the pistil of the short-styled.
93   69
77   69
48   53
43   9
0   0
0   0
—   0
61 per cent. of the flowers yielded capsules. Each capsule contained, on an average, 64·6 seed.</td>
</tr>
<tr>
<td>III.
10 flowers fertilized by the longer stamens of the long-styled.
0   14
0   0
0   0
0   0
—   0
23
Too sterile for any average.</td>
<td>IV.
10 flowers fertilized by the longer stamens of the mid-styled.
0   0
0   0
0   0
0   0
—   0
0
Too sterile for any average.</td>
</tr>
</table>

"white thread," and those by the longer stamens of the long-styled form by "white silk;" a flower fertilized in the latter manner would have yielded about 136 seed, and it may be observed that one such pod is missing, viz., at the bottom of compartment 1. Therefore I have hardly any doubt that I fertilized a flower marked with "white thread," as if it had been marked with "white silk." With respect to the capsule which yielded 92 seed, in the same column with that which yielded 136, I do not know what to think. I endeavoured to prevent pollen dropping from an upper to any lower flower, and I tried to remember to wipe the pincers carefully after each fertilization; but in making eighteen different crosses, sometimes on windy days, and pestered by bees and flies buzzing about, some few errors could hardly be avoided. One day I had to keep a third man by me all the time to prevent the bees visiting the uncovered plants, for in a few seconds' time they might have done irreparable mischief. It was also extremely difficult to exclude minute Diptera from the net. In 1862 I made the great mistake of placing a mid-styled and long-styled under the same huge net: in 1863 I avoided this error.

Table III.—Short-styled Form (*continued*).

V. 10 flowers fertilized by *own* longer stamens.		VI. 10 flowers fertilized by *own* shorter stamens.	
0	0	64?*	0
0	0	0	0
0	0	0	0
—	0	—	0
0	0	21	0
0		9	
Too sterile for any average.		Too sterile for any average.	

I fertilized a number of flowers without particular care with their own two pollens, but they did not produce a single capsule; the position of the stigma within the calyx renders the fertilization without some care difficult.

Summary of the three preceding Tables.

Long-styled form.—Twenty-six flowers fertilized by the stamens of corresponding length, borne by the mid- and short-styled forms, yielded 61·5 per cent. of capsules, which contained, on an average, 89·7 seed.

Twenty-six flowers fertilized by the other and shorter stamens of the mid- and short-styled forms yielded only two very poor capsules.

Thirty flowers fertilized by this form's own two sets of stamens yielded only eight very poor capsules; but flowers well fertilized by bees by one or both of their own kinds of pollen produced numerous capsules containing, on an average, 21·5 seed.

Short-styled form.—Twenty-five flowers fertilized by the stamens of corresponding length, borne by the long- and mid-styled forms, yielded 72 per cent. of capsules, which (excluding one capsule with only nine seeds) contained, on an average, 70·8 seed.

Twenty flowers fertilized by the longer stamens of the long- and mid-styled forms yielded only two very poor capsules.

Twenty flowers fertilized by both their own two sets of stamens yielded only two poor (or perhaps three) capsules.

Mid-styled form.—Twenty-four flowers fertilized by the stamens of corresponding length, borne by the long- and short-styled forms, yielded 96 (probably 100) per cent. of capsules, which con-

* I suspect that, by mistake, I fertilized this flower with the pollen of the shorter stamens of the long-styled form, and it would then have yielded about 64 seed. Flowers to be thus fertilized were marked with black silk; those with the pollen of the shorter stamens of the short-styled with black thread; and thus, I suspect, the mistake arose.

tained (excluding one capsule with 12 seed), on an average, 117·2 seed.

Fifteen flowers fertilized by the longer stamens of the short-styled form yielded 93 per cent. of capsules, which (excluding four capsules with less than 20 seed) contained, on an average, 102·8 seed.

Thirteen flowers fertilized by the shorter stamens of the long-styled form yielded 54 per cent. of capsules, which capsules (excluding one with 19 seed) contained, on an average, 60·2 seed.

Twelve flowers fertilized by own longer stamens yielded 25 per cent. of capsules, which (excluding one with 9 seed) contained, on an average, 77·5 seed.

Twelve flowers fertilized by own shorter stamens yielded not a single capsule.

Considering the three Tables and this summary, we may safely draw the following conclusions. First, that, as in structure so in function, there are three females or female organs: this is manifest; for when all three receive the very same pollen, they are acted on most differently. So conversely with the thirty-six stamens, we know that they consist of three separate sets of a dozen each, differing in various respects; and in function the pollen of these three sets when applied to one and the same stigma acts most differently, as a glance at the Tables proves. But we shall presently see that the action of the pollen of the whole dozen longest and of the whole dozen shortest stamens is not identical.

Secondly, we see that only the longest stamens fully fertilize the longest pistil, the middle stamens the middle pistil, and the shortest stamens the shortest pistil. And now we can comprehend the meaning of the almost exact correspondence in length between the pistil of each form and the two half-dozen sets of stamens borne by the two other forms; for the stigma of each form is thus rubbed against the same spot of the insect's body, which becomes most charged with the proper pollen. In all three forms, the female organ is but feebly, or not at all, acted on by its own two kinds of pollen. In my papers on the dimorphism of *Primula* and *Linum*, I used the terms "heteromorphic" for the fully fertile unions between the female element of the one form and the male element of the other, and "homomorphic" for the less fertile or quite sterile unions between the female and male elements of the same form. The principle involved in these terms holds good with *Lythrum*, but is insufficient; for though in each of the three forms the fertile unions are all *heteromorphic*, the ap-

propriate pollen coming from the stamens of corresponding length borne by the other two forms, and though the *homomorphic* unions of the females with their own two sets of males are always more or less sterile, there remain in each case two other sterile unions, not included in these two terms. Hence it will be found convenient to designate the two unions of each female with the two sets of stamens of corresponding length, which are fully fertile, as *legitimate unions*, and the four other, more or less sterile, unions of each female with the four other sets of stamens as *illegitimate unions*. Consequently, of the eighteen possible unions between the three forms, six are legitimate and twelve are illegitimate.

Another and curious conclusion cannot be considered as proved, but is rendered highly probable, by the Tables. The unions of the pistils and stamens of equal length are alone fully fertile. Now with the several illegitimate unions it will be found that the greater the inequality in length between the pistil and stamens, the greater the sterility of the result. There is no exception to this rule. Thus, with the long-styled form, its own shorter stamens are far less equal in length to the pistil than its own longer stamens; and the capsules fertilized by the pollen of the shorter stamens yielded fewer seeds: the same comparative result follows from the use of the pollen of the shorter stamens of the mid-styled form, which are much shorter than the shorter stamens of the short-styled (see diagram), and therefore less equal in length to the long-styled pistil. We shall see exactly the same result if we look to the four illegitimate unions under the mid- and short-styled forms. Certainly the difference in sterility in these several cases is very slight, but the sterility always increases with the increasing inequality of length between the pistil and the stamens which are used. Therefore I believe in the above rule; but a vast number of artificial unions would be requisite to prove it. If the rule be true, we must look at it as an incidental and useless result of the gradational changes through which this species has passed in arriving at its present condition. On the other hand, the correspondence in length between the pistil of each form and those stamens which alone give full fertility is clearly of service to the species, and is probably the result of direct adaptation.

Some of the illegitimate unions yielded, as may be seen in the Tables, during neither year a single seed; but, judging from the case of the long-styled plant, it is probable, if such unions could be effected repeatedly under the most favourable conditions, some few seeds would be produced. Anyhow, I can state that in all

the eighteen possible unions the pollen-tubes penetrated, after eighteen hours, the stigma. I have reason to believe that the offspring from the illegitimate unions present some singular characteristics; but until my observations on this head are repeated, I must be silent. At first I thought that perhaps two kinds of pollen placed together on the same stigma would give more fertility than any one kind; but we have seen that this is not the case with each form's own two kinds of pollen; nor is it probable in any case, as I occasionally got, by the use of single kinds of pollen, fully as many seed as I have seen in a capsule naturally fertilized. Moreover the proper pollen from a single anther is more than sufficient to fully fertilize each stigma; hence, in this as in so many other cases, at least twelve times as much of each kind of pollen is produced as is necessary to ensure full fertilization. From the dusted condition of the whole body of those bees which I caught on these flowers, it is probable that some pollen of all kinds is deposited on each stigma; but there can hardly be a doubt that the pollen of the stamens of corresponding length will be prepotent and will wholly obliterate any effect from the other kinds of pollen, even if previously deposited on the stigma. I infer this partly from the fact ascertained by Gärtner that each species' own pollen is so prepotent over that of any other species, that if put on the stigma many hours subsequently, it will entirely obliterate the action of the foreign pollen. But I draw the above inference especially from the following experiment: I fertilized homomorphically or illegitimately some long-styled Cowslip flowers (*Primula veris*) with their own pollen, and exactly twenty-four hours subsequently I fertilized these same stigmas heteromorphically or legitimately with pollen from a short-styled dark-red Polyanthus. I must premise that I have raised many seedlings from crossed Cowslips and Polyanthus, and know their peculiar appearance; and I further know, by the test of the fertility of the mongrels *inter se*, and with both parent forms, that the Polyanthus is a variety of the Cowslip, and not of the Primrose (*P. vulgaris*) as some authors have supposed. Now from the long-styled Cowslip twice fertilized in the manner explained, I raised twenty-nine seedlings, and every one of them had flowers coloured more or less red; so that the heteromorphic Polyanthus-pollen wholly obliterated the influence of the homomorphic pure Cowslip-pollen, which had been placed on the stigmas twenty-four hours previously, and not a single pure Cowslip was produced.

The last conclusion which may be deduced from the Tables, even from a glance at them, is that the mid-styled form differs from both the others in its much higher capacity for fertilization. Not only did the twenty-four flowers fertilized by the stamens of corresponding lengths, all, or all but one, yield capsules rich in seed; but of the other four illegitimate unions, that by the longer stamens of the short-styled form was highly fertile, though less than in the two legitimate unions, and that by the short stamens of the long-styled form was fertile to a considerable degree; the two unions with this form's own pollen were sterile, but in different degrees. So that the mid-styled form, when fertilized by the six kinds of pollen, evinces five different grades of fertility. By comparing compartments 3 and 6 in Table II. we learn a remarkable fact, namely, that though the pollen from the short stamens of the long-styled and from this form's own (mid-styled) short stamens, used in these two unions, is identical in all respects, yet that its action is widely different; in the one case above half the fertilized flowers yielded capsules containing a fair number of seed; in the other case not one single capsule was produced. So, again, the green, large-grained pollen from the long stamens of the short-styled and from this form's own (mid-styled) long stamens is identical in all respects, but its action, as may be seen in compartments 4 and 5, is widely different. In both these cases the difference in action is so plain that it cannot be mistaken, but it can be corroborated. If we look to Table III., to the legitimate action of the short stamens of the long- and mid-styled forms on the pistil of the short-styled form, we again see a similar but slighter difference, the pollen of the short stamens of the mid-styled form yielding a smaller average of seed during the two years of 1862 and 1863 than that from the short stamens of the long-styled form. Again, if we look to Table I., to the legitimate action of the green pollen of the two sets of long stamens, we shall find exactly the same result, viz. that the pollen of the long stamens of the mid-styled form yielded during both years fewer seeds than that from the long stamens from the short-styled form. Hence it is certain that the two kinds of pollen produced by the mid-styled form are less potent than the similar pollens produced by the corresponding stamens of the two other forms.

When we see that the capsules of the mid-styled form yield a considerably larger average number of seed than those of the other two forms,—when we see how surely the flowers are fertilized in the legitimate unions, and how much more productive

the illegitimate unions are than those of the other two forms, we are led to consider the mid-styled form as eminently feminine in its nature. And although it is impossible to consider as rudimentary or aborted the two perfectly developed sets of stamens of the mid-styled form which produce an abundance of perfectly well-developed pollen, yet we can hardly avoid connecting, as balanced, the higher efficiency of the female organ with the lesser potency of the two mid-styled pollens.

Finally, it is proved by the Tables that *Lythrum salicaria* habitually produces or consists of three females different in structure and widely different in function; that it produces or consists of three sets of males widely different in structure and function; and that two of the three sets of males are subdivided into subgroups of half a dozen each, differing in a marked manner in potency, so that regularly five kinds of pollen are elaborated by this one species of *Lythrum*.

Lythrum Græfferi.—I must now say a few words about some of the other species of the genus. I have examined numerous dried flowers of *L. Græfferi*, each from a separate plant, kindly sent me from Kew. This species, like *L. salicaria*, is trimorphic, and the three forms apparently occur in about equal numbers. In the long-styled form the pistil projects about one-third of the length of the calyx beyond its mouth, and is therefore shorter than in *L. salicaria*; the globose and hirsute stigma is larger than that of the other two forms; the longer stamens, which are graduated in length, have their anthers standing just above and just beneath the mouth of the calyx; the half-dozen shorter stamens rise rather above the middle of the calyx. In the mid-styled form the stigma projects just above the mouth of the calyx, and stands almost on a level with the longer stamens of the previous form; its own longer stamens project well above the mouth of the calyx and stand a little above the level of the stigma of the long-styled form; the shorter stamens correspond in all respects with the shorter ones in the previous form. In the short-styled form the stigma of the pistil is nearly on a level with the anthers of the shorter stamens in the two preceding forms; and the longer stamens correspond with the longer stamens of the mid-styled form, and the shorter stamens with the longer stamens of the long-styled form. In short, there is a close general correspondence in structure between this species and *L. salicaria*, but with some differences in the proportional lengths of the parts. Nevertheless the fact of each of the three pistils having two sets

of stamens, borne by the two other forms, of corresponding lengths, comes out conspicuously. In the mid-styled form the distended pollen-grains from the longer stamens had nearly double the diameter of those from the shorter stamens; so that there is a greater difference in this respect than in *L. salicaria.* In the long-styled form, also, the difference in diameter between the pollen-grains of the longer and shorter stamens was plainer than in *L. salicaria.* These comparisons, however, must be received with caution, as they were made on specimens long kept in a dried condition.

Lythrum thymifolia.—This form, according to Vaucher*, is dimorphic like *Primula*, and therefore presents only two forms. I received two dried flowers from Kew, which presented two forms: in the one form the stigma projected far beyond the calyx, in the other it was included within the calyx; in this latter form the style was only one-fourth of the length of the style of the other form. There are only six stamens; these are somewhat graduated in length, and in the short-styled form the anthers stand a little above the stigma, but yet the stamens by no means equal in length the pistil of the long-styled form; in the long-styled form the stamens are rather shorter than in the other form. These six stamens alternate with the petals, and correspond homologically with the longer stamens of *L. salicaria* and *L. Græfferi.* As there are only six stamens, it is scarcely possible that this species can be trimorphic.

Lythrum hyssopifolia.—This species is said by Vaucher, but I believe erroneously, to be dimorphic. I have examined dried flowers from twenty-two separate plants from various localities, kindly sent to me by Mr. Hewett C. Watson, Prof. Babington, and others. These were all essentially alike. Hence the species cannot be dimorphic. The pistil varies somewhat in length, but when unusually long the stamens are likewise generally long; in the bud the stamens are short: perhaps these circumstances deceived Vaucher. There are from six to nine stamens, graduated in length; the stamens which are variable in being present or absent correspond with the six shorter stamens of *L. salicaria* and with the six which are absent in *L. thymifolia.* The stigma is included within the calyx, and stands in the midst of the anthers, and would generally be fertilized by them; but as the stigma and anthers are upturned, and as, according to Vaucher, there is a passage left in the upper side of the flower to the nectary, there can hardly be a doubt that

* Hist. Phys. des Plantes d'Europe, tom. ii. (1841) pp. 369, 371.

the flowers are visited by insects, which would occasionally bring pollen from other flowers of the same or of any adjoining plant, as surely as occurs with the short-styled *L. salicaria*, of which the pistil and corresponding stamens closely resemble those of *L. hyssopifolia*. According to Vaucher and Lecoq*, this species, which is an annual, generally grows almost solitarily, whereas the three preceding species are social; and this alone would almost have convinced me that *L. hyssopifolia* cannot be dimorphic, as such plants cannot habitually live by themselves any better than one sex of a diœcious species.

Nesæa verticillata.—I raised a number of plants from seed sent me by Professor Asa Gray, and they presented three forms. These differed from each other in the proportional lengths of their organs of fructification and in all respects in very nearly the same way as the three forms of *Lythrum Græfferi*. The green pollen-grains from the longest stamens, measured along their greater axis and not distended with water, were $\frac{13}{7000}$ of an inch in length; those from the stamens of middle length $\frac{9\text{-}10}{7000}$, and those from the shortest stamens $\frac{8\text{-}9}{7000}$ of an inch.

We have seen that the genus *Lythrum* affords trimorphic, dimorphic, and monomorphic species.

The inquiry naturally arises, why do these species differ so remarkably in their sexual relations? of what service can reciprocal dimorphism or trimorphism be to certain species, whilst other species of the same genus present, like the great majority of plants, only one form? I have elsewhere given too briefly† the

* Géograph. Bot. de l'Europe, tom. vi. (1857) p. 157.

† 'Origin of Species,' 3rd edit., p. 101. Hugo von Mohl has recently (Bot. Zeitung, 1863, S. 309, 321), in a most interesting paper, advanced the case of the minute, imperfectly developed, closed and self-fertile flowers borne by *Viola*, *Oxalis*, *Impatiens*, *Campanula*, &c., as an argument against my doctrine that no species is self-fertilized for perpetuity. I may state that in the spring of 1862 I examined some of these flowers, and saw, though less thoroughly, all that H. von Mohl has so well described. I can add only one remark, which I believe is correct, that in *V. canina* there is an open channel for the pollen-tubes from the extremity of the stigma to the ovarium; for I gently pressed a minute bubble of air repeatedly backwards and forwards from end to end. Though the imperfectly developed and the perfect flowers are so different in structure, it is a rather curious case of correlation, that in the double purple Violet (*V. odorata*) the minute imperfect flowers are double to the very core, so that a section appears like the head of a cabbage when cut through. There can be, as von Mohl asserts, no doubt that these flowers are always self-fertilized; they are moreover specially adapted for this end, as may be seen in the remarkable difference in the shape of the pistil in *V. canina* (and in a less degree in *V. hirta* and the single *V. odorata*) as compared with that of the perfect flower;

general grounds of my belief that with all organic beings distinct individuals at least occasionally cross together, and reciprocal dimorphism is plainly one most efficient means for ensuring this result.

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and in the pollen-tubes which proceed from the grains within the anthers in *V. canina*, and from within the lower anthers of *Oxalis acetosella*, having the wonderful power of directing their course to the stigma. If these plants had produced the minute closed flowers alone, the proof would have been perfect that they could never have crossed with other individuals. I am aware that in some of these cases it has been stated that the perfect flowers never produce any seed; as far as *Amphicarpæa* is concerned, I hear from Professor Asa Gray that the petaliferous flowers certainly sometimes yield seed. The completely enclosed flowers of that curious grass, the *Leersia oryzoides*, as described by M. Duval-Jouve (Bull. Soc. Bot. de France, tom. x. 1863, p. 194), apparently offer the best case of perpetual self-fertilization; for when perfect flowers are protruded from the culms, they are, as far as is yet known, always sterile. In a number of plants kept by me in pots in water, not one single perfect flower has protruded, but the enclosed flowers produced plenty of seed. Without wishing to throw any doubt on M. Duval-Jouve's excellent observations, I may add that with the enclosed flowers borne by my plants, the act of fertilization, that is, the penetration of the stigma by the pollen-tubes, took place in the air and not in fluid within the glumes. With the exception of the *Leersia*, as the case now stands, I cannot see how the production of the small, imperfect flowers invalidates my doctrine that no species is perpetually self-fertilized, more than the multiplication of many plants by bulbs, stolons, &c. As I observe that the production of seed by the perfect flowers of *Viola* is spoken of as something capricious and accidental, I may state that, although it varies much in different years, it depends exclusively on the visits of bees; I ascertained this by marking many flowers thus visited, and finding that they produced capsules, and by covering up many flowers which (excepting a few that I artificially fertilized) did not, when thus protected, produce a single capsule. After bees have visited these flowers, the pollen may be seen scattered on the papillæ and on the stigma itself, and they can hardly fail thus to cross distinct individuals. These remarks apply to *V. canina*, *hirta*, and *odorata*; with *V. tricolor* the case is somewhat different; but I must not enlarge any more on this subject. The production by so many plants of perfect and expanded, as well as of imperfect and closed flowers, seems to me to throw much light on many points; it shows how extraordinarily little pollen is necessary for full fertilization, for I ascertained with *V. canina* that the perfect and imperfect flowers (the latter producing so few pollen-grains) yielded the same average number of seeds; it shows us that fertilization can be perfected in closed flowers; it shows us that large, highly coloured petals, perfume, and the secretion of nectar are by no means indispensable for this act, even in those species which properly possess these characters. It seems to me that the necessity of an occasional cross with a distinct individual of the same species explains the universal presence of at least some expanded flowers, at the expense of injury from rain and the loss of much pollen by innumerable pollen-robbing insects; it explains the enormous superfluity of pollen from its liability to loss from these causes and during conveyance from flower to flower; it explains the use of a gaily coloured corolla, perfume, and nectar, namely, to attract insects, except in those comparatively few cases in which wind is the agent, and in these the last-named attributes are deficient.

This result would appear to be one of high importance, for with dimorphic plants it is ensured at the risk of occasional sterility; not only is the pollen of each plant useless or nearly useless to that individual, but so is the pollen of all the plants of the same form, that is, of half the total number of individual plants. In that extensive class of plants called by C. K. Sprengel dichogams, in which the pollen of each flower is shed before its own stigma is ready, or in which the stigma (though this case occurs more rarely) is mature before the flower's own pollen is ready sterility can hardly fail to be the occasional result; and it would be the inevitable result with both dichogamous and reciprocally dimorphic flowers unless pollen were carried by insects (and in some few species by the wind) from one flower or plant to the other. As with reciprocal dimorphism so with dichogamy, within the same genus some of the species are and some are not thus characterized. Again, in the same genus, as in that of *Trifolium*, some species absolutely require insect-aid to produce seed, others are fertile without any such aid; now when insects are requisite for fertilization, pollen will generally be carried from one flower to the other. We thus see, by means of reciprocal dimorphism, of dichogamy, and of insect-aid, that some species require, or at least receive, incessant crosses with other individuals of the same species; whereas other species of the same genera can be, and probably are often fertilized during long periods by the pollen of their own flowers. Why this wide difference in the frequency of crosses should occur we are profoundly ignorant. I will only further remark on this head, that it would be a great mistake to suppose that many flowers, which are neither reciprocally dimorphic nor dichogamous, nor require insect-aid for their fertilization, nor show any particular adaptation in their structure for the visits of insects, are not habitually crossed with the pollen of other individuals; this occurs, for instance, habitually with cabbages, radishes, and onions, which nevertheless are perfectly fertile (as I know by trial) with their own pollen without aid of any kind.

But it may be further asked, granting that reciprocal dimorphism is of service by ensuring at each generation a cross (but I am far from pretending that it may not have some additional unknown signification), why did not dimorphism suffice for *L. salicaria* and *Græfferi*? why were they rendered reciprocally trimorphic, entailing such complicated sexual relations? We cannot answer, except perhaps so far:—if we suppose two plants of

the *L. salicaria* to grow by themselves, then if the species were dimorphic it would only be an equal chance in favour of the two turning out different forms and consequently both being fertile; but as the species is trimorphic and each form can fertilize the two other forms, it is two to one in favour of the two turning out different forms and being consequently both fertile. We thus see how reciprocal trimorphism must be an advantage; and probably it would be more advantageous to this Lythrum, which commonly grows in almost a single row along the banks of streams, than it would be to Primroses or Cowslips which have neighbours on all sides. But even if trimorphism effected no good beyond that gained by dimorphism, we ought not to feel much surprised at its occurrence, for we continually see throughout nature the same end gained by the most complicated as well as by the most simple means: to give one instance:—in many diœcious plants pollen is carried from the male to the female by the wind, which is perhaps the simplest method conceivable, or by the adherence of the grains to the hairy bodies of insects, which is a method only a little less simple; but in *Catasetum* the conveyance is effected by the most complex machinery; for in this orchid we have sensitive horns which when touched cause a membrane to rupture, and this sets free certain springs by which the pollen-masses are shot forth like an arrow, and they adhere to the insect's body by a peculiar viscid matter, and then by the breaking of an elastic thread of the right strength the pollen is left sticking to the stigma of the female plant. The complexity of the means used in this and in many other cases, in fact depends on all the previous stages through which the species has passed, and on the successive adaptations of each part during each stage to changed conditions of life.

As some authors consider reciprocal dimorphism to be the first step towards diœciousness, the difficulty of understanding how a trimorphic plant like *Lythrum salicaria* could become diœcious should be noticed; and as dimorphism and trimorphism are so closely allied, it is not probable that either state is necessarily in any way related to a separation of the sexes—though it may occasionally lead to this end. As far as *Lythrum salicaria* is concerned, the one tendency which we can discover is towards the abortion of the two sets of stamens in the mid-styled form. This tendency is evinced by its pollen, though abundant and apparently good, yielding a smaller percentage of seed than does the pollen of the corresponding stamens in the other two forms; and this

fact is in itself curious, and shows by what insensibly graduated steps nature moves. If this tendency were carried out the mid-styled form would become a female, depending for its fertilization on two sets of stamens in the long- and short-styled forms; and these two forms would reciprocally fertilize each other like the two forms of *Primula* or *Linum*; but there would be no approach to a diœcious condition.

As the case of the trimorphic species of *Lythrum* is so complicated, and as it is easier to perceive the relations of the sexes in the animal than in the vegetable kingdom, it may be worth while to give, before concluding, a somewhat elaborate simile. We may take the case of a species of Ant, and suppose all the individuals invariably to live in three kinds of communities; in the first, a large-sized female (not to specify other differences) living with six middle-sized and six small-sized males; in the second, a middle-sized female with six large- and six small-sized males; and in the third community, a small-sized female with six large- and six middle-sized males. Each one of these three females, though enabled to unite with any male, would be nearly sterile with her own two sets of males, and likewise with two other sets of males living in the other two communities; for she would be fully fertile only when paired with a male of her own size. Hence the thirty-six males, distributed by half-dozens in the three communities, would be divided into three sets of a dozen each; and these sets, as well as the three females, would differ from each other sexually in exactly the same manner as distinct species of the same genus. Moreover the two sets of males living in the community of the extraordinarily fertile middle-sized female would be less potent sexually than the males of corresponding size in the two other communities. Lastly, we should find that from the eggs laid by each of the three females, all three sorts of females and all three sorts of males were habitually reared—proving to demonstration that all belonged to one and the same species.

To appreciate fully this remarkable case of the reciprocally trimorphic species of *Lythrum,* we may take a glance at the two great kingdoms of nature and search for anything analogous. With animals we have the most astonishing diversity of structure in the so-called cases of alternate generation, but as such animals have not arrived at maturity, they are not properly comparable with the forms of *Lythrum.* With mature animals we have extreme differences in structure in the two sexes; we have in

some of the lower animals males, females, and hermaphrodites of the same species; we have the somewhat more curious case of certain Cirripedes which are hermaphrodites, but are sexually aided by whole clusters of what I have called complemental males; we have, as Mr. Wallace has lately shown, the females of certain Lepidoptera existing under three distinct forms; but in none of these cases is there any reason to suspect that there is more than one female or one male sexual element. With certain insects, as with Ants, in which there exist, besides males and females, two or three castes of workers, we have a slightly nearer approach to our case, for the workers are so far sexually affected as to have been rendered sterile. With plants, at least with phanerogamic plants, we have not that wonderful series of successive developmental forms so common with animals; nor could this be expected, as plants are fixed to one spot from their birth, and must be adapted throughout life to the same conditions. With plants we have sexual differences in structure, but apparently less strongly marked than with animals, from causes which are in part intelligible, such as there being no sexual selection; again, we have that class of dimorphic flowers so ably discussed recently by Hugo von Mohl, in which some of the flowers are minute, imperfectly developed, and necessarily self-fertile, whilst others are perfect and capable of crossing with other flowers of the same species; but in these several cases we have no reason to suspect that there is more than one female or one male sexual element. When we come to the class of reciprocally dimorphic plants, such as *Primula*, *Linum*, &c., we first meet with two masculine and two feminine sexes. But these cases, which seemed only a short time since so strange, now sink almost into insignificance before that of the trimorphic species of *Lythrum*.

Naturalists are so much accustomed to behold great diversities of structure associated with the two sexes, that they feel no surprise at the fact; but differences in sexual nature have been thought to be the very touchstone of specific distinction. We now see that such sexual differences—the greater or less power of fertilizing and being fertilized—may characterize and keep separate the coexisting individuals of the same species, in the same manner as they characterize and have kept separate those groups of individuals, produced from common parents during the lapse of ages or in different regions, which we rank and denominate as distinct species.

Notes on the Sterility and Hybridization of certain Species of *Passiflora, Disemma,* and *Tacsonia*. By Mr. JOHN SCOTT. Communicated by C. DARWIN, Esq., F.R.S. & L.S.

[Read June 16, 1864.]

IN the Royal Botanic Gardens of Edinburgh, plants of the *Passiflora racemosa, cærulea,* and *alata* have been grown for a number of years; yet Mr. M'Nab has informed me that, though annually yielding a profusion of blooms, he has never known them to produce a single seed. That this sterility originates in the impotent action of the male and female sexual elements on each other, and not merely, as might be suspected, from the pollen not reaching the stigmas, I have fully satisfied myself by continued experiments throughout the flowering seasons of 1861 and 1862. During both seasons I fertilized on each plant of the above-named species a vast number of flowers with their own pollen, but not one of them produced a single seed. I may also state, as further confirmatory of the functional impotence of at least *P. racemosa* and *P. alata*, that similar experiments have been made by one or two other young men in the Botanic Gardens with the same result. In one or two instances, indeed, in our experiments on *P. racemosa* fruits were produced; but these proved destitute of seed, the walls of the ovaries being alone developed.

A similar inveterate self-sterility in plants of the above species has been frequently noticed; and in one or two instances it has been found (but I have no books at hand for reference) that, though thus utterly impregnable to their own pollen, they are nevertheless susceptible to fertilization by that of certain allied species, while the potency of their own pollen has been proved by its effectively fertilizing other species. Accordingly, in 1863, I again instituted a series of experiments on these plants of the *Passiflora racemosa, cærulea,* and *alata*, in the Botanic Gardens of Edinburgh, by way of eliciting the nature of their sterility, and proving whether or not they were susceptible to reciprocal fertilization with other individuals of the same, or of allied species. The results of these experiments are so curious, that I think it will be worth while to communicate them to the Society in detail; they are as follows*.

* I am greatly indebted to Mr. J. B. Sterling for giving me pollen from a plant of the *P. alata* in the nurseries of the Messrs. Lawson and Sons, Edinburgh; and for trying experiments on this plant with its own pollen and with that of other species. I have also to express my thanks to a gentleman at

1. First for *P. racemosa* as female.—I placed pollen of the *P. alata* No. 1 upon the stigmas of ten flowers of the *P. racemosa*; seven of these set, but four of them only reached maturity, and yielded an average of 123 apparently good seeds per fruit, while the others dropped off early and contained no good seeds. Four flowers on the *P. racemosa* fertilized with pollen of the *P. alata* No. 2 resulted differently, as the ovary of not even one swelled. Again, six flowers on the *P. racemosa* fertilized with pollen of the *P. alata* No. 3 produced three fruits, two of which shanked off while the other ultimately maturing yielded 114 apparently good seeds.

By applying pollen of *P. cærulea* No. 1 to the stigmas of six flowers of the *P. racemosa*, I obtained two fruits; these contained 235 seeds, of which 197 were apparently good. Pollen of *P. cærulea* No. 2 applied to the stigmas of eight flowers of the *P. racemosa* failed to effect the swelling of even one germen. I had ultimately similar results by placing pollen of the *P. cærulea* No. 3 upon the stigmas of eight flowers of the *P. racemosa*, though I had hopes of a different result from the early swelling of three germens, but these shanked off. By applying pollen of *P. edulis* to the stigmas of six flowers of *P. racemosa*, one ovary alone swelled, but this dropped off prematurely and contained no good seeds. Again, experiments on *P. racemosa* with pollen of the *Tacsonia pinnatistipula* resulted in the abortion of all the ovaries: but I was more successful in my experiments with *P. racemosa* and *T. mollissima*, inasmuch as from six flowers of the former fertilized by pollen of the latter I got three ovaries to swell; one of these alone matured, and yielded 142 seeds, of which 22 seemed good. Lastly, I fertilized 20 flowers on the *P. racemosa* with own pollen: though, as we have above shown, it

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Keith Hall, Perthshire, for sending me pollen from plants of the *P. alata* and *P. cærulea*, and likewise for trying experiments on the former species with pollen from another individual which I sent him. The results of these experiments will be given in the sequel. For the sake of brevity, however, I will here affix numbers to each of the plants of the *P. alata* and *cærulea* experimented upon, so that I may not have further occasion for noticing the particular plant of which I may be treating; thus, *P. cærulea*, Nos. 1 & 2, refer to plants growing in the Botanic Gardens of Edinburgh; *P. cærulea*, No. 3, to a plant growing in the gardens, Keith Hall; *P. alata*, No. 1, plant growing in the Botanic Gardens, Edinburgh; *P. alata*, No. 2, plant growing in the gardens, Keith Hall; *P. alata*, No. 3, plant growing in the nurseries of the Messrs. Lawson and Sons, Edinburgh.

is perfectly susceptible of fertilization with the pollen of other species, one of these ovaries alone set, and this proved utterly void of seeds.

2. *P. cærulea* No. 1 as female.—I placed pollen of *P. cærulea* No. 2 upon the stigmas of four flowers of *P. cærulea* No. 1, and the ovaries of two of these swelled slightly, but they ultimately shanked without yielding any seed. I had more successful results with pollen of *P. cærulea* No. 3 upon the stigmas of *P. cærulea* No. 1, as, from four flowers thus treated, three ovaries set, of which only one shanked off, while the others, fully maturing, yielded conjointly 237 apparently good seeds. I also succeeded in fertilizing *P. cærulea* No. 1 with pollen of *P. racemosa*, as six flowers thus treated produced three ovaries; of these two shanked off, only one maturing; this yielded 115 seeds, of which 87 were to all appearance good. Again, by applying pollen of *P. alata* No. 1 to the stigmas of *P. cærulea* No. 1, the fruits in every case aborted; and so in experiments on *P. cærulea* No. 1 with pollen of *P. edulis*, the ovaries of not even one swelled. Lastly, I fertilized twelve flowers of the *P. cærulea* No. 1 with own pollen, but all of them dropped off without effecting the slightest development of a single ovary.

3. *P. cærulea* No. 2 as female.—I placed pollen of *P. cærulea* No. 1 upon the stigmas of four flowers of the *P. cærulea* No. 2, and thus got three ovaries to set; of these two shanked off; the other, maturing, contained 154 seeds, of which 143 seemed to be good. Again, from four flowers of the *P. cærulea* No. 2 fertilized with pollen of the *P. cærulea* No. 3, I obtained three fruits, and these yielded in all 293 seeds, of which 262 were good. I also succeeded in fertilizing *P. cærulea* No. 2 with pollen of the *P. racemosa*, as, from three flowers thus treated, I obtained one fine plump fruit; this contained 105 seeds, of which 68 were apparently good. Again, by placing pollen of *P. alata* No. 1 upon the stigmas of four flowers of the *P. cærulea* No. 2, I got one ovary to set; this, however, dropped off prematurely and contained no good seed. Lastly, on *P. cærulea* No. 2 I impregnated eight flowers with own pollen; the results, however, in accordance with my previous experiments, showed that this plant, though susceptible to fertilization by pollen of other individuals of the same species, and also by that of other species, was nevertheless utterly impregnable to its own pollen, as all the flowers thus treated dropped off without effecting the setting even of a single ovary.

4. I placed pollen of the *P. alata* No. 2 upon the stigmas of

eight flowers of the *P. alata* No. 1. The ovaries of four of these swelled for some time, but ultimately one of them shanked off, while the other three reached perfection and yielded in all 674 seeds, of which 560 appeared to be good. By the converse experiment the results were very different; thus, four flowers of the *P. alata* No. 2 were impregnated with pollen of the *P. alata* No. 1, but each of these dropped off, without affording the slightest symptoms of fertilization. Again, on the *P. alata* No. 1 I fertilized six flowers with pollen of *P. alata* No. 3; but though the ovaries of two of these set, and continued swelling for some time, they ultimately dropped prematurely and did not yield any good seed. I also had in this case the converse experiment tried for me, and from four flowers on the *P. alata* No. 3 fertilized with pollen of the *P. alata* No. 1, one ovary was induced to set; but, as in the converse case, this did not continue to swell. Seeing, however, that in either of these cases so few flowers were experimented upon, we may, I think, with justice be permitted to infer from the results that more extended experiments would show them capable of reciprocally fertilizing each other. I dissected some flowers of these three plants of *P. alata* which had been treated with each other's pollen, and found the stigmas abundantly penetrated by pollen-tubes. This fact, together with the swelling of the ovaries, shows a much higher degree of reciprocal susceptibility to each other's pollen than exists (as we shall presently see) in any one of these plants when fertilized with pollen from the same individual plant.

The following results of experiments on the *P. alata* No. 1 as female with pollen of other species may also be worthy of notice in this place, from the fact that similar or reciprocal unions have been effected by different experimenters; and, further, that in at least one of the cases to be mentioned—that of *P. alata* No. 1 by pollen of *P. racemosa*—I have found, as above shown, that fertile unions may be readily effected, while the others, either directly or indirectly, dovetail themselves into each other by curious and complex fertile conjunctions, as will be found by a careful study of my experiments as detailed. First, I placed pollen of *P. racemosa* on the stigmas of ten flowers of the *P. alata* No. 1, but these all dropped off, without so much as the ovary of one swelling. Secondly, sixteen flowers on the *P. alata* No. 1 were impregnated with pollen from the plants Nos. 1 & 2 of *P. cærulea*, but in these cases also every ovary aborted. Thirdly, in the case of *P. alata* No. 1 by pollen of *P. edulis* the results

were not materially different, as from six flowers thus treated one ovary alone set, but this did not continue swelling. Fourthly, six flowers of *P. alata* No. 1 proved impregnable to pollen of *Tacsonia mollissima*, while a similar number of flowers on the former fertilized with pollen of the *Tacsonia pinnatistipula* differed simply in the early setting of two of their ovaries, as neither continued swelling. Lastly, I applied pollen of the *Disemma Adiantoides* to the stigmas of six flowers of the *P. alata* No. 1, but this also proved ineffective, as the ovaries of not even one set.

With respect to the power of self-fertilization in the above three plants of *P. alata*, I may state that there is absolute impotence. I have already adduced evidence of this in *P. alata* No. 1 from experiments in the flowering seasons of 1861 and 1862. I repeated these in 1863 with similar results, as, from 20 flowers fertilized with own pollen, not one ovary exhibited the slightest symptoms of pollinic influence. On the plant of *P. alata* No. 2 a vast number of flowers have been from time to time fertilized, but the results showed a most inveterate self-sterility in the invariable abortion of every ovary. Again, experiments on the susceptibility of *P. alata* No. 3 to fertilization by its own pollen resulted also, according to Mr. Sterling, in the continued abortion of the ovaries. I have already stated, in previously giving the experiments on the reciprocal fertilization of *P. alata* Nos. 1 & 2, that the pollen of either, on being applied to the other's stigmas, produces pollen-tubes which freely penetrate their stigmatic tissues. In the action, however, of either stigma on its own pollen there is this material difference, that though it occasionally excites the development of the pollen-tubes, it is rarely penetrated by them.

Though the pollen of each of these plants of *P. alata* is thus utterly impotent on its own stigma, we have nevertheless shown it to be perfectly good in its relations with other individuals of the same species or with distinct species. As further illustrative, however, of the potency of the pollen of one of the above plants, I will here give the results of experiments with it on the stigmas of the *Disemma Adiantoides* and *coccinea*, both of which are also easily fertilized with their own pollen. Thus, on *D. Adiantoides* I fertilized three flowers by own pollen; each of these set, and produced fine plump ovaries, which yielded conjointly 720 good seeds. By applying pollen of *P. alata* No. 1 to six flowers of *D. Adiantoides*, I got four ovaries to set; two of these came to perfection and conjointly yielded 258 seeds, of which 46, judging

from external appearance, were good. Again, three flowers on the *D. coccinea* fertilized by own pollen produced three fine fruits and 586 good seeds. On the stigmas of six other flowers of *D. coccinea* I placed pollen of the *P. alata* No. 1, and got two ovaries to set, but only one continued swelling, and yielded in all 74 seeds, of which only 12 were plump and apparently good.

5. In the Royal Botanic Gardens of Edinburgh there are, besides these perfectly self-sterile individuals already noticed, plants of two other species of *Passiflora* worthy of a passing notice from a similar inveterate self-sterility. These are the *P. holosericea* and *P. manora*. First, for their reciprocal fertilization, I placed pollen of *P. manora* upon the stigmas of ten flowers of the *P. holosericea*; the ovaries of seven of these set, and ultimately produced, in so far as could be judged from the plump, round, palish-yellow ovaries, perfect fruits. On dissecting these, however, I was disappointed to find that the walls of the ovary had alone been developed, and that they were all destitute of aught but the veriest rudiments of seeds. I have frequently repeated this experiment, and in every instance I found that the development of the ovaria of the *P. holosericea* may thus be readily effected by the pollen of the *P. manora*, whereas it is utterly impotent in exciting the slightest development of the seeds. I likewise tried the converse experiment, and applied pollen of *P. holosericea* to the stigmas of ten flowers of the *P. manora*; of these only one ovary set, but this soon shanked off. Though I have frequently repeated this experiment, I have not again got a single ovary to set. Again, with respect to the fertilization of these species with own pollen, I may state generally that though I have thus fertilized a vast number of flowers on both plants in the successive flowering seasons of 1862 and 1863, yet in no instance did a single fruit set. I also examined the stigmas of several flowers on both plants after the application of own pollen, and invariably found that the stigmas had failed to excite the development of a single pollen-tube. On the other hand, pollen of the *P. manora* readily protrudes its tubes when placed on the stigmas of *P. holosericea*, though, as we have shown, it utterly fails in effecting the vitalization or even development of the seeds. In the converse experiments I also examined the stigmas of *P. manora* after being covered with the pollen of *P. holosericea*, and in several instances found the pollen-tubes protruding and penetrating the stigmas, though, as we have seen, they fail to effect a fertilizing influence.

6. Lastly, I have to notice the results of experiments on plants of the *Tacsonia pinnatistipula* and *mollissima* growing in the Royal Botanic Gardens of Edinburgh. It had been observed that the plant of the *T. pinnatistipula*, though annually producing a profusion of blooms, rarely produced a single fruit; and, further, that when the latter were produced the seeds were always imperfect. It thus became the subject of the following experiments. In 1862 between 100 and 200 flowers were fertilized with own pollen, yet from these only three ovaries swelled; one dropped off prematurely; the two others came to perfection, forming large, plump, orange-like fruits. On cutting these open, I found in them an abundance of seeds; but these proved all imperfect, as on examination they were found destitute alike of embryo and surrounding albuminous matter, the hard sculptured spermoderms having alone been developed. From this sterility to own pollinic influence, I determined to try these flowers with pollen of other species. Accordingly, in 1863, I placed pollen of *T. mollissima* on the stigmas of six flowers of the *T. pinnatistipula*; of these three set fruits, but two of them shanked off; the one which came to perfection contained 190 seeds, of which 52 were embryonated. I likewise tried the converse experiment, and placed pollen of the *T. pinnatistipula* on six flowers of the *T. mollissima*, and thus got three ovaries to set; one of these was entirely destitute of seeds, while the others conjointly yielded 116 seeds, but these were all small and imperfectly developed.

From the results of experiments in 1862, we have seen that the *Tacsonia pinnatistipula* could not be impregnated with its own pollen. Nevertheless, from the above favourable results with pollen of the *T. mollissima*, I determined to again test its impotence with its own pollen, which is known to be good when applied to another species. I accordingly fertilized ten flowers with own pollen; but the results simply confirmed those derived from previous experiments, as the ovaries of not even one swelled. With respect to the self-fertility of the *T. mollissima* the case is very different, as I have found it fruit freely when treated with own pollen, and, further, that these fruits yield an abundance of good embryonated seeds.

There is another point here worthy of a passing notice. In the above experiments on *Passiflora racemosa* as female, we have seen that this species is susceptible of fertilization by the pollen of *Tacsonia mollissima*. In the converse experiment, however, the results are different, the pollen of *P. racemosa* proving utterly

TABLE OF PURE AND MIXED UNIONS OF SPECIES OF *PASSIFLORA*, *DISEMMA*, AND *TACSONIA*.

	Total number of flowers fertilized.	Total number of ovaries produced.	No. of ovaries which dropped prematurely.	Number of good ovaries.	Total number of seeds.	Number of apparently good seeds.
1. Passiflora racemosa by pollen of P. cærulea No. 3	8	3	3	...	......	......
2. Passiflora racemosa by pollen of P. cærulea No. 1	6	3	1	2	235	197
3. Passiflora cærulea No. 1 by pollen of P. racemosa	6	3	2	1	115	87
4. Passiflora racemosa by pollen of P. cærulea No. 2	8	0	...	...	......	......
5. Passiflora cærulea No. 2 by pollen of P. racemosa	3	1	...	1	105	68
6. Passiflora racemosa by pollen of Tacsonia mollissima	6	3	2	1	142	22
7. Tacsonia mollissima by pollen of Passiflora racemosa	6	0	...	...	......	......
8. Passiflora racemosa by pollen of P. alata No. 1	10	7	3	4	784	512
9. Passiflora alata No. 1 by pollen of P. racemosa	10	0	...	...	......	......
10. Passiflora racemosa by pollen of P. alata No. 3	6	3	2	1	158	114
11. Passiflora cærulea No. 1 by pollen of P. cærulea No. 2	4	2	2	...	......	......
12. Passiflora cærulea No. 2 by pollen of P. cærulea No. 1	4	3	2	1	154	143
13. Passiflora cærulea No. 1 by pollen of P. cærulea No. 3	4	3	1	2	243	237
14. Passiflora cærulea No. 2 by pollen of P. cærulea No. 3	4	3	...	3	293	262
15. Passiflora alata No. 1 by pollen of P. alata No. 2	8		1	3	674	560
16. Passiflora alata No. 2 by pollen of P. alata No. 1	4	...	...	...	......	......
17. Passiflora alata No. 1 by pollen of P. alata No. 3	6	2	2	...	......	......
18. Passiflora alata No. 3 by pollen of P. alata No. 1	4	1	1	...	......	......
19. Passiflora alata No. 1 by pollen of Disemma Adiantoides	6	...	...	...	......	......
20. Disemma Adiantoides by pollen of Passiflora alata No. 1	6	4	2	2	258	46
21. Disemma Adiantoides by own pollen	3	3	...	3	731	720
22. Disemma coccinea by pollen of Passiflora alata No. 1	6	2	1	1	74	12
23. Disemma coccinea by own pollen	3	3	...	3	596	586
24. Passiflora holosericea by pollen of P. manora	10	7	...	7	no seeds.	
25. Passiflora manora by pollen of P. holosericea	10	1	1	...	......	......
26. Tacsonia pinnatistipula by pollen of Tacsonia mollissima	6	3	2	1	190	52
27. Tacsonia mollissima by pollen of Tacsonia pinnatistipula	6	3	1	2	116	0
28. Passiflora racemosa by own pollen	20	1	1	...	......	......
29. Passiflora cærulea No. 1 by own pollen	12	...	...	...	......	......
30. Passiflora cærulea No. 2 by own pollen	8	...	...	...	......	......
31. Passiflora alata No. 1 by own pollen	20	...	...	...	......	......
32. Passiflora alata No. 2 by own pollen	12	...	...	...	......	......
33. Passiflora alata No. 3 by own pollen	12	...	...	...	......	......
34. Passiflora holosericea by own pollen	24	...	...	...	......	......
35. Passiflora manora by own pollen	18	...	...	...	......	......
36. Tacsonia pinnatistipula by own pollen	10	...	...	...	......	......
37. Tacsonia mollissima by own pollen	3	3	...	3	740	721

impotent on the stigmas of the *T. mollissima*, for not even one of the ovaries thus treated swelled.

For facility of reference, I will here subjoin, in a tabulated form, though in a somewhat different order, the more interesting results of the foregoing experiments.

Conclusion.—In the annexed Table we have the results of 37 distinct unions, in which 294 flowers were experimented upon, and the following curious phenomena are exhibited in the functional correlations of the sexual elements.

First, from ten unions of *Passiflora racemosa*—six unions as female and four as male—with other species, six fertile conjunctions were the result. Of these, one instance alone occurs in which the two species reciprocally fertilized each other, viz. in the case of *P. racemosa* and *P. cærulea* No. 1. With the two other plants of *P. cærulea* Nos. 1 & 2, *P. racemosa* treated as female yielded nothing, whereas by a converse experiment, *P. cærulea* No. 2 by pollen of *P. racemosa*, successful conjunctions were effected (*vide* Table, line 5). Again, *P. racemosa* may be readily fertilized by pollen of two individuals of the *P. alata* Nos. 1 & 3 (*vide* Table, lines 8 & 10), yet I failed in effecting a converse union by applying pollen of the *P. racemosa* to the *P. alata* No. 1. Similar results were derived from experiments on the *P. racemosa* and the *Tacsonia mollissima*, pollen of the latter proving potent on the stigmas of the former, whereas in the converse case the pollen of the *P. racemosa* is utterly ineffective on the stigmas of the *T. mollissima*. Though the *P. racemosa* will thus simply or reciprocally unite with the above species, it will be seen, by looking at line 28 of Table, that it is, nevertheless, perfectly sterile when treated with its own pollen. It is further worthy of remark that, with the exception of *T. mollissima*, the other five plants experimented upon likewise proved insusceptible of fertilization by their own pollen.

Secondly, in lines 11 to 14 inclusive of the Table we have the results of four unions in each case between three plants of the *P. cærulea*. These show that the pollen of an individual, A 1, for example, will readily fertilize the female element of another individual, A 2, whereas A 2 will not fertilize A 1; yet the female elements of both A 1 & 2 are susceptible of fertilization by the pollen of a third individual, A 3. Again, by consulting lines 29 & 30 of the Table, we see that the plants here given as A 1 & 2 cannot be fertilized by their own pollen, and I am told that plant A 3 is likewise insusceptible to fertilization by its own pollen.

Thirdly, we have the complicated results of the pure and mixed

unions of the three individual plants of the *P. alata* one with another, and with distinct species. Of the four pure unions given in lines 15 to 18 inclusive of the Table, one alone is fertile; thus the female element of A 1 can be fertilized by the male element of A 2, but the male element of the former fails to effect fertilization on the female element of the latter. Nearly similar results are afforded in the reciprocal experiments with A 1 and A 3, in which we have no fertile unions, though we have clearly symptoms of a conjunctive susceptibility in the setting of three of the ovaries (*vide* Table, lines 17 & 18). Again, the male elements of two of these plants of *P. alata*, A 1 & 2 respectively, fertilize the female element of the *P. racemosa*; and the male element of A 1 will fertilize two distinct species of the nearly allied genus *Disemma* (*vide* Table, lines 20 & 22). Though we have here proofs of the potency of the male element of these three plants of the *P. alata* and of the goodness of the female element of one of them, they nevertheless all proved utterly impregnable by their own pollen (*vide* Table, lines 31, 32 & 33).

Fourthly, we have the curious results of the unions between *P. holosericea* and *P. manora* (*vide* Table, lines 24 & 25), in which the male element of the latter effects the perfect development of the ovaries of the former, while it utterly fails in effecting the slightest development of the seeds. Again, in the converse experiment the male element of the *P. holosericea* is almost impotent on the female element of the *P. manora*, as only in one instance did a single ovary set, and this did not continue swelling. When these two species are fertilized with their own pollen we find utter impotence, as shown in lines 34 & 35 of the Table, for in a large number of flowers thus fertilized in no single instance did an ovary set.

Lastly, the male element of the *Tacsonia mollissima* effectively fertilizes the female element of the *T. pinnatistipula*, while in the converse experiment, though the pollen of the *T. pinnatistipula* applied to the stigmas of *T. mollissima* effects the perfect development of the ovarian coats and the hard or spermodermic coverings of the seed, it utterly fails in effecting the development of the embryo and albuminous matter. Again, *T. pinnatistipula*, though in general very insusceptible to own pollinic influence, does in rare cases, as shown in previous details, yield a fine plump ovary filled with apparently good seeds. On examination, however, I have invariably found that the spermoderm and albumen had alone been developed, while the embryo was entirely absent.

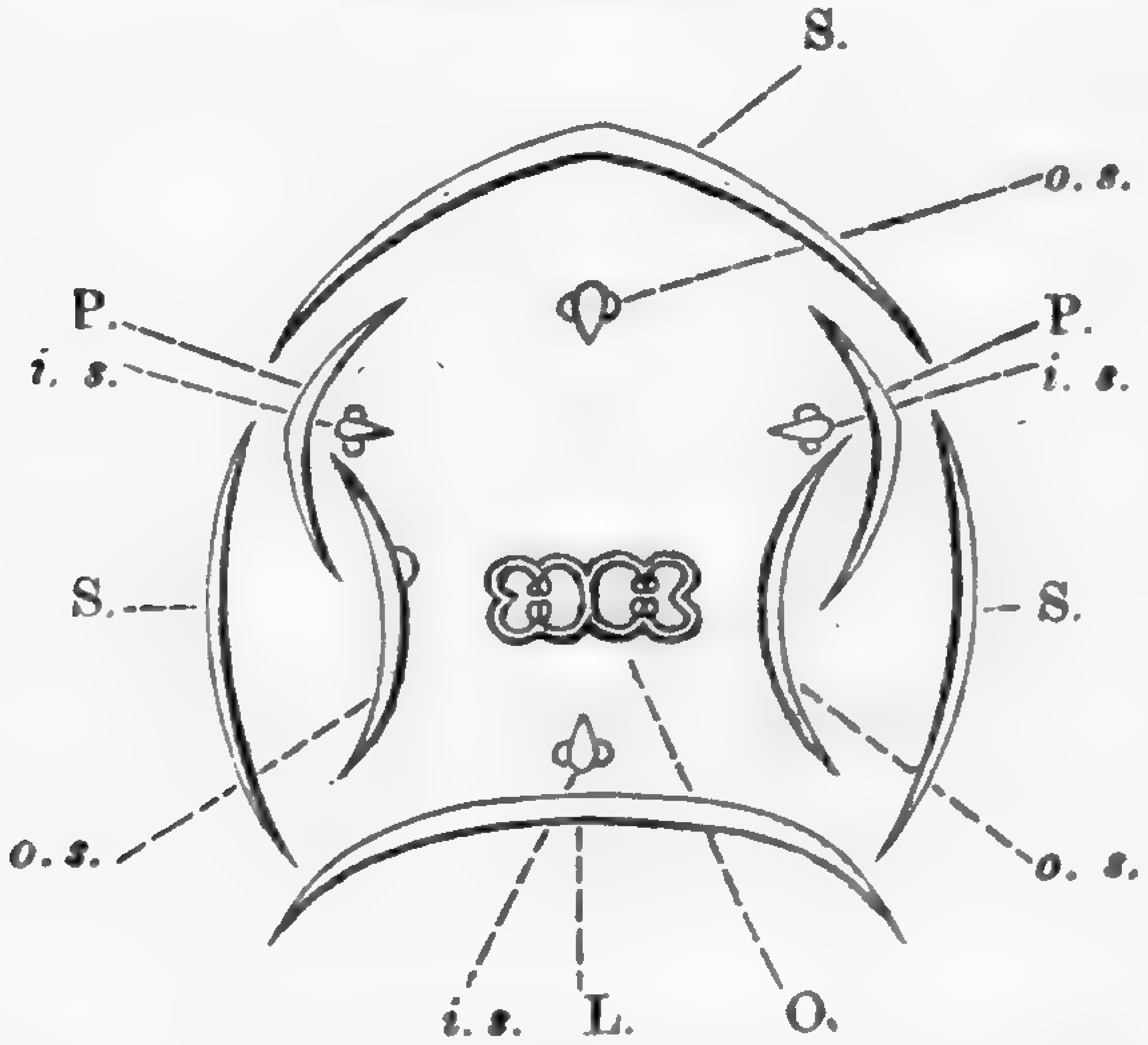
On a Peloria and Semidouble Flower of *Ophrys aranifera*, Huds.

By MAXWELL T. MASTERS, M.D., F.L.S.

[Read June 16, 1864.]

THE flower, an account of which I now beg leave to lay before the Society, has a special interest, inasmuch as it presents (so far as I have been able to ascertain) a larger number of distinct parts, and a nearer approach to the typical form of Orchis flower than any yet discovered. It formed one of a series recently gathered in the vicinity of Folkestone, and all of which differed more or less from the ordinary condition. The present one is selected for comment as being the most perfect and complete of the whole, and combines in itself most of the peculiarities of structure met with in the other flowers, together with others special to itself. The flower in question was one of a cluster of three, which exhibited an increase in the number of the stamens, &c.; this, the lowermost of the group, had, as may be seen from the diagram accompanying this note, three sepals, five petals, four columns, and a two-celled inferior ovary, with four parietal placentas. On closer inspection it was found that the three sepals were not at all different from those of the normal flower. The three petals next in succession were also, in form and position, in their ordinary state. In colour, however, the two upper lateral petals differed from what is customary, in having the same purplish-brown tint

Ophrys aranifera.



S.S.S. Sepals. P.P. Petals. L. Labellum.
o. s. Outer stamens, the two lateral ones petaloid, one bearing half an anther.
i. s. Inner stamens. O. Ovary.

which characterizes the lip. Within these petals, at the upper part of the flower, there was the ordinary column, and at the

opposite side, alternating with the petals before mentioned, two additional lip-like petals, one provided with a half-anther containing a single perfectly formed pollen-mass. It is, perhaps, worthy of notice that the arrangement of the coloured spots on the true labellum, and that on the adventitious lips, replacing the two lower of the outer stamens, were not of a similar character. The supernumerary lips had the π-shaped marking which is so very common in this species, while the true lip was, as to its spots, much more like *O. apifera*. Alternating with this last whorl were three "columns," all apparently perfectly formed and differing only from the ordinary one in their smaller size. The ovary had the characters already mentioned. Viewing this flower with reference to the theoretical structure of Orchid flowers, as explained by Robert Brown*, and more recently by Mr. Darwin†, its peculiarities (save those of the ovary) seem susceptible of ready explanation. The first and second whorls are but little affected; the third whorl, which, under ordinary circumstances, is represented by a single column, is here present in the form of one perfect column and two petaloid ones; of the latter, one, indeed, is provided with half an anther (as in *Canna*). These petaloid columns are usually not developed as distinct organs, but are inseparably fused with the labellum. I may here add, that I found numerous instances in which one or both of the lateral petals were adherent to the column, thus illustrating that tendency to adhesion between these organs which is (supposing Mr. Darwin's views to be correct) so remarkably carried out in the case of the lip. The fourth whorl of three columns corresponds precisely to the inner staminal whorl, which is usually entirely wanting. In the *Ophreæ*, indeed, Mr. Darwin‡ declares that the spiral vessels, by which the presence of this inner row of stamens in other Orchids may be detected, are not to be found. The two-celled pistil is not so easily explained. At first sight it appeared as if there had been a fusion of two pistils and an obliteration of two placentas; but if this view be taken, it will be very difficult to account for the number and position of the other whorls of the flower, which are so readily referable to the typical form.

For the sake of comparison, I subjoin a brief notice of some of the deviations from the ordinary structure of the andrœcium in Orchids, as recorded by various observers.

In *Dendrobium normale*, Falconer, not only is the perianth

* Linn. Trans. xvi. p. 685. † Fertilization of Orchids, p. 286.

‡ *Op. cit.* p. 296, *adnot.*

regular, but the column is triandrous *, the three stamens (according to the diagram of its structure given by Lindley †) pertaining to the outer row. Richard, as cited by Moquin-Tandon, Lindley, and others, describes and figures a peloria of *Orchis latifolia* with regular triandrous flowers ‡.

In a flower of *Habenaria chlorantha*, described by the late Prof. Henslow §, the outer three stamens are suppressed, while two of the inner group are present, as happens normally in *Cypripedium.*

Wydler describes a flower of *Ophrys aranifera* in which one outer and two inner stamens were present ‖. I have myself met with three such flowers among the series referred to in the beginning of this note.

Alphonse DeCandolle ¶ figures a flower of *Maxillaria* in exactly the same condition, so far as the stamens are concerned, as those just mentioned. It is curious to observe that in many of these cases the two lateral petals are suppressed.

Dr. J. E. Gray exhibited at the Botanical Society of London, in August 1843, a specimen of *Ophrys apifera* with a triandrous column, the supernumerary anthers belonging, apparently, to the inner whorl.

In his Catalogue of the Plants of South Kent, the Rev. G. E. Smith ** describes and figures a flower of *O. aranifera* with a triandrous column, seemingly of the same kind as that spoken of by Dr. Gray.

I have examined in the Royal Gardens at Kew a flower of *Cattleya crispa* in which were three stamens, the central one normal; the two lateral ones, belonging probably to the inner whorl, were in appearance like the lateral petals, and one of them was adherent to the central perfect column. A flower of *Cattleya violacea* also afforded me a similar instance; but in this case only one of the inner stamens was developed, and this in the form of a small petal, partly adherent to the column.

Dr. Seubert †† figures a flower of *Orchis palustris* in which there were four placentas alternating with the outer divisions of the perianth; but in this case the pistil was one-celled, and the whole

* Lindl. Orchidol. of India, Journ. Linn. Soc. iii. p. 9.

† Lindl. Veg. K. ed. 3. p. 183, *a*.

‡ Mém. Soc. d'Hist. Nat. ii. 1. p. 212, pl. 3.

§ Journ. Linn. Soc. ii. p. 104.

‖ Archiv der Botan. ii. p. 300, tab. 16. fig. 11.

¶ Monstr. Végét., in Neue Denkschrift. p. 17, pl. 7.

** P. 56, tab. 4. fig. 16.

†† Linnæa, xvi.

flower tetramerous, with the exception of the stamens, only one of which was perfect as in the ordinary flower.

The only figure of a double Orchis, that I am acquainted with, is that given by Jacob in his Catalogue of the Plants of Faversham, published in 1777, which figure represents, apparently, a perfectly regular double flower of *Orchis Morio*; but how the doubling is produced there is no evidence to show. It will be remarked that none of these instances, except, possibly, Dr. Jacob's flower, presented so large a number of organs and so close an approximation to the theoretical construction of the flower, as the one which I now bring under the notice of the Society as the most perfect form of irregular peloria yet observed among Orchids.

Since the above remarks were laid before the Society, I have been made acquainted with two other instances of malformed Orchis flowers which are too interesting to be passed over. The first (for a knowledge of which I am indebted to the kindness of Professor Asa Gray and Mr. Darwin) occurred in some specimens of *Pogonia ophioglossoides* collected by Dr. J. H. Paine in a bog near Utica, New York. It will be seen from the following description that these flowers presented an almost precisely similar condition to those of the *Ophrys aranifera* before mentioned. "The peculiarities of these flowers," writes Professor Gray, "are that they have three labella, and that the column is resolved into small petaloid organs. The blossom is normal as to the proper perianth, except that the labellum is unusually papillose, bearded almost to the base. The points of interest are, first, that the two accessory labella are just in the position of the two suppressed stamens of the outer series, viz. of A^2 and A^3, as represented in the diagram*; and there is a small petaloid body on the other side of the flower, answering to the other stamen, A^1. Secondly, in one of the blossoms, and less distinctly in another, two lateral stamens of the inner series, a^1 and a^2, are represented each by a slender naked filament. There are remaining petaloid bodies enough to answer for the third stamen of the inner series and for the stigmas, but their order is not well to be made out in the dried specimens."

The other instance to which I have alluded is one published by Dr. Moore of Glasnevin in Seemann's Journal of Botany (1864). In this case the flowers of *Orchis pyramidalis* are described as double, the sepals and petals being multiplied, and the stamens

* Darwin, Fertiliz. of Orchids, p. 292.

and pistils partly petaloid. Furthermore, in some of the flowers which Dr. Moore was kind enough to forward me for examination I found not only an increase in the number of petals, especially of the labella, but also central floral prolification—a small raceme, that is, standing up in the centre of the flower in the situation usually occupied by the column, here entirely wanting. What is very remarkable also is, that each of the accessory flower-buds is again the subject of prolification. This is, I believe, the first recorded instance of median floral prolification in this natural order, and as such should be added to the list given in my paper on that subject*.

Observations on the Morphology and Anatomy of the Genus *Restio*, Linn., together with an Enumeration of the South African Species. By Maxwell T. Masters, M.D., F.L.S.

[Read April 16, 1863.]

[Plates XIV. & XV.]

For the opportunity of studying the genus *Restio*, or more properly speaking, the South African species of that group, I am especially indebted to the kindness of Drs. Hooker and Sonder, and of Professors Harvey and Daubeny. These gentlemen have with great liberality placed their collections at my disposal for study and examination, and I can only regret that my imperfect leisure and the pressure of other avocations should have prevented me from repaying their kindness by laying before the Society a more perfect account of these plants than is to be found in the following observations. Crude and ill-digested as they may be, I would yet hope that they may be of some little service to botanists, as, from the abundant material at my disposal, I trust I have been able to rectify some errors into which my predecessors in this field have fallen from want of sufficient evidence. Dr. Sonder's collections have been of especial service to me, not only from being more complete and copious than any other, but also because they contain many of Nees von Esenbeck's typical species, labelled by the author himself, and frequently also accompanied by manuscript notes.

The origin of the genus *Restio* is somewhat curious. It was first published by Linnæus†, not before it had been recognized as

* Trans. Linn. Soc. vol. xxiii. p. 369.

† Syst. Nat. ed. 12. tom. ii. p. 735, Addenda, anno 1766.

distinct by Rottboell, who assigned to it the manuscript name *Kyllinga**, a name which he subsequently transferred to a genus of Cyperaceæ on finding that he had been forestalled by Linnæus. Linnæus took as the type of his genus a species which he called *R. dichotomus*, the only one, apparently, known to him when he established the genus, and which he considered at that time as identical with *Schœnus Capensis*. Rottboell, in the works cited below, added several new species, which were adopted and others added in the following or 13th edition of the 'Systema' (1791). Great confusion exists in books, and still greater in herbaria, as to Linnæus' *R. dichotomus*, the species upon which the genus was established. Rottboell considered it as identical with his own plant, figured in his Descr. et Ic. tab. 1. fig. 1, and which is now known as *Thamnochortus dichotomus*, Br.† Linnæus' description is so vague, that by its aid alone the plant intended could hardly be recognized; it runs thus, "Gramen sæpe sterile, quasi viviparum, e foliis minutissimis aliquot pilis interstinctis." Linnæus' own copy of the 12th edition of the 'Systema,' now preserved with his herbarium in the library of our Society, contains numerous manuscript notes in the author's own handwriting, and, fortunately for our present purpose, there is an annotation referring to *R. dichotomus*, and which I here transcribe, in the hope that it will definitely settle the synonymy of this much-disputed species: "*Thamnochortus fruticosus*, Berg. Fl. Cap. 353. t. 5. f. 8 (1767). Differt a *Schœno Capensi*, quæ alia planta . . . . ." Hence the original *R. dichotomus* is no *Restio* at all, but a *Thamnochortus*, whose further synonymy I hope to unravel in a future communication. The species subsequently added by Rottboell, Linnæus, and others are partly retained, partly distributed through the genera *Calopsis*, *Elegia*, *Thamnochortus*, *Staberoha*, *Hypodiscus*, &c., and which I hope to make the subjects of future communications to the Society. For the purposes of this paper I adopt the genus as defined by Kunth‡, which thus includes those diœcious Restiaceæ with persistent sheaths, flowers in spikelets, each provided with a two-rowed perianth of six, or rarely four, unequal segments. In the male flowers, which are generally numerous, the anthers are one-celled; in the female spikelets the florets are rarely solitary, and if so, not strictly terminal. The fruit is a one-, two-, or, very rarely, three-celled dehiscent capsule. Among

* Rottb. Program. 1772; ejusdem Descr. et Ic. 1773, p. 1.

† Brown, Prod. 244 in adnot. of Kunth, Enum. iii. p. 433. n. 7.

‡ Enum. Plant. iii. p. 382.

diœcious plants, of which it commonly happens that botanists are cognizant of one sex alone, and among which the sexes are very liable to be wrongly matched, the limitation of the genera must of necessity be very uncertain. This uncertainty and confusion pervades the writings of authors on this and allied genera, and I cannot but think that observers should refrain from publishing new groups in this family until they are in a position to examine and describe both sexes.

As I proceed, I shall, I believe, be enabled to show that, as Nees surmised, *R. aristatus*, Thunb., and some few allied species differ greatly as to their female flowers from true Restios, although the male flowers are indistinguishable from those of the latter genus. In this particular instance the male plants are common in herbaria, and are comparatively well known to botanists; but the female plants are so rare, that hitherto I have only met with them in Dr. Sonder's herbarium, wherein they are named by Nees himself. The last-mentioned botanist has incurred some blame for assigning so well-known a plant as *R. aristatus* to a new genus, but this I believe to be due to the cause already mentioned, viz., the rarity of female plants in collections. On the other hand, Steudel's genus *Ischyrolepis* must, from the evidence I shall adduce, be suppressed, and merged in the genus *Restio* (see *R. subverticillatus*).

But the consideration of this portion of my subject I propose to defer until after I have given an account of the organography and minute anatomy of the genus *Restio*—an account which, however imperfect, will apply in many points *mutatis mutandis* to the other genera of the order.

In outward appearance and habit these plants have much of the aspect of their near allies the Sedges and the Rushes. Their roots present little worthy of comment, being merely simple fibres of woody texture and more or less flexuose habit, descending from the under surface of the stock. In *R. triflorus*, Rottb., and some other species the fibres spread horizontally for some distance, and do not at once descend. The direction may possibly be connected with the nature or depth of the soil in which the plants grow.

Rhizome or Rootstock.—This is usually contracted and small, giving origin to the roots below, and throwing up the culms from its upper surface; occasionally it is extended horizontally, and is then spoken of as "creeping," though this habit seems not common in this particular genus of Restiaceæ. In what I believe to

be a new species, *R. Harveii*, mihi, this creeping rhizome is more clearly marked than in most other species.

Culm.—All writers who have described species of this order speak of the branches thrown up from the rootstock as "culms," and although Bischoff and other terminologists restrict the use of the word "culm" to the order Gramineæ, and apply the term "calamus" to such stem-structures as we have in *Restio*, I have deemed it advisable to retain the word "culm" for this family, as sanctioned by the invariable practice of Linnæus, Thunberg, Robert Brown, and I believe of all systematic writers. In the face of such overwhelming authority it would be pedantic, to say the least, to employ another term, and it would moreover lead to confusion.

The culms then ascend more or less vertically upwards from the rhizome,—if of large diameter, then in comparatively small numbers; if small and filiform, then generally they are numerous and tufted. In either case they are simple or more or less branched, the branches bearing the inflorescence at their extremity or being merely sterile. The sterile branches are often distinct in habit and appearance, as in function, from the fertile ones. In form, the culm and its branches, whether fertile or barren, are generally cylindrical, but may be more or less compressed or angular. Where the branches are numerous and crowded, the compressed form is evidently due to that accommodation process of which the order presents so many marked illustrations. *R. tetragonus*, Thunb., is the only species, so far as I am aware, whose culm is markedly tetragonal; in this case the branches are slightly compressed, and their sides fit into the grooves of the parent culm. The surface of the culm and its subdivisions is either smooth, tuberculated, or studded with minute depressions. The colour varies even in the same specimen, and greatly depends on the age of the plant; that of the dried specimen differs considerably, so far as I have had the opportunity of observing, from that of the living plant.

The disposition of the branches affords occasionally a useful means of discriminating the species. The culm ordinarily divides di- or trichotomously, but occasionally the subdivisions are more numerous, and then we have the branches coming off in fascicles or tufts, while at other times, as in *R. subverticillatus*, the branchlets are verticillate. The main culm divides near to its base, or towards the centre, or quite at the upper portion, thus giving a distinctive aspect to the plant, although the characters so afforded

have no great value in the discrimination of species. The same remark applies, though to a less extent, to the direction of the branches, whether erect or more or less spreading, &c.

Foliage.—The leaves in these plants are for the most part reduced merely to the sheath, with a mere rudiment of a stalk or blade, but as they vary in form with the different parts of the culm, it is necessary to speak of them according to their position. The base of the culms is always invested by a number of closely imbricated leaf-sheaths (cataphyllary leaves*). These are usually of a dark colour and an elliptic form, with a mucro or awn projecting from their dorsal surface, just below the apex, almost exactly as in *Juncus.* These scales always closely invest the base of the culm, and increase in size from below upwards, passing more or less gradually in form and colour to those on the middle and upper portion of the culm. The culm-leaves, or "vaginæ" as they are technically called, are separated one from the other by considerable intervals; below they merge into the stock-leaves, while above, with more or less abruptness, they merge into the bracts or scales of the inflorescence. These sheaths encircle the stem, sometimes closely, at other times more loosely: this difference, though apparently of little physiological importance, furnishes, from its constancy, a good character for the discrimination of species, while the disunion of the margins of the sheath throughout the whole order is a character of importance as separating its members from the Cyperaceæ. The form of the upper portion of the sheath varies considerably, very generally the margins are membranous and more or less hyaline. From the middle of the back of the sheath, just below the apex, projects an organ, which, according to its form and size, is spoken of as an awn, a mucro, or even a leaf. In *R. graminifolius*, Kunth, this so-called leaf is more highly developed than in any other species yet met with. Morphologically, this portion may be considered to be the upper part of the leaf-stalk, assuming that the true leaf-blade is absent in these plants as indeed in the majority of Monocotyledons. If this be so, have we not in the membranous apex of the sheath the homologue of the "ligula" of Grasses, and similar formations? In the culm-sheaths the true nature of the awn or mucro is not in general so well shown as in the sheaths of the smaller branches, where the awn usually assumes the appearance of a curved needle-shaped leaf. In these smaller sheaths

* See Henfrey's translation of Braun's 'Rejuvenescence,' Ray Society, 1853, p. 62, &c.

it commonly happens that the membranous apex of the sheath becomes cleft into two divisions, in which case the resemblance to a needle-shaped leaf with two membranous adnate stipules is very marked. In some species of the allied genus *Hypolæna* the membranous edge of the sheath is regularly cut up into a number of hair-like *laciniæ*, similar to those constituting the "ligula" of *Saccharum*, &c.

In many of the species, and most markedly so in *R. venustulus*, *R. laniger*, and *R. scoparius*, the sheaths enclose an inner oblong scale, which is marked on one surface with two prominent hairy ribs. This scale is placed at the bifurcation of the culm or branch, and apparently serves as a kind of cushion or pad, the culm or branch fitting into the groove between the two projecting "costæ."

Bracts.—The bracts or scales of the inflorescence do not differ materially from the other foliar organs just mentioned; ordinarily they are shorter and do not completely encircle the axis as the lower ones do. The lowermost or outermost bract is sometimes different from the rest, having then more of the character of the true culm-sheaths; in this case it may be compared to the spathe of Arads, or the outer glume of Grasses. In many instances the bract next above the lowermost, and which is pressed up against the axis, has the oblong form, and the two woolly ribs, such as have just been mentioned as occurring in the forks of the branches in *R. venustulus* and many other species. Pressure here evidently determines the presence of these two ribs, as probably also in the instance of the inner palea of Grasses, which occupies a precisely similar position with reference to the axis. Other illustrations of the same kind may be noticed in *Iris*, in *Philydrum*, &c., in those bracts which are pressed between the axis and the flower-bud.

The bracts are sometimes all about of the same size and form, while at others the lower ones are the smallest, and gradually increase upwards till they approach the top of the spikelet, when they again diminish in size; in the latter situation also they often lose the mucro or awn which the lower scales are for the most part provided with*.

Good specific characters are afforded by the comparative length of the bracts and of the florets they subtend, a difference which may be of physiological importance with reference to the facilities

* The observer cannot fail to be struck with the foliaceous awn projecting from the back of the inner involucral scale of *Picris echioides* just below the apex, exactly as in the sheaths of Restiaceæ or in the paleæ of Grasses.

for ensuring fertilization, but upon which points no evidence yet exists.

Inflorescence.—This consists in both the male and female plants of spikes or spikelets of various forms and sizes, according to the species or to the age of the individual plant. The spikelets are sometimes placed singly at the ends of the culms or branches, more frequently they are disposed in cymes, the cymes being more or less dense, sometimes spike-like, or more frequently paniculate. In some cases the inflorescence of the male and female plants is alike, while in others it differs; in this latter case the male plant generally has numerous spikelets arranged in panicled cymes, while the female spikelets are less numerous and spicate in their arrangement. Occasionally monœcious plants are met with wherein both male and female spikelets occur in the same inflorescence. Kunth mentions this in *R. intermedius*, and I have met with it in *R. ferruginosus*. The individual spikelets are erect or spreading, very rarely pendent; some are sessile (terminal), others pedicellate, the pedicel being compressed from side to side, grooved lengthwise to accommodate the spikelet, and increasing in breadth from below upwards. In *R. triticeus*, as observed by Rottboell, the back of the spikelets is parallel to the rachis—in other words, the spikelets are attached to the rachis in a transverse manner as in *Triticum*. In the great majority of the species the spikelets have their edges (not their backs) turned towards the rachis, as happens also in *Lolium* among Grasses. From the cylindrical or somewhat globose form of the spikelets in some instances, it becomes difficult to ascertain the real position of the spikelets with reference to the axis. If the spikelets be crowded, they are somewhat curved so as to get out of one another's way; but if the spikelets are placed at some distance one from another, no such curvature is necessary.

In *R. graminifolius* a peculiar circular cushion-like pad of cellular tissue is to be seen at the angles formed by the diverging pedicels. The purport of this little cushion is unknown to me; its existence has not, so far as I am aware, been previously noted, nor have I yet seen anything similar in any other species.

Each spikelet consists of a number of bracts or scales, in the axils of some or all of which are placed the flowers. In the male plants all the bracts, with the exception perhaps of the outermost or lowest and the one next above it, are fertile, while in the female spikelets it not unfrequently happens that one or two only of the upper scales have flowers in their axils. The scales are arranged

in spiral series, the number of scales in each cycle being different in different species. In *R. quinquefarius*, N. ab E., the scales are arranged in five well-marked vertical ranks, separated one from another by deep grooves*.

The male flowers, as also the immature female ones, are compressed from back to front, and are straight, or so curved as to be convex on the surface nearest the bract, while their outline generally coincides with that of the protecting bract.

The peculiar form of the florets is due to pressure against the axis; it exactly resembles the form of the unexpanded buds of the garden hyacinth while they remain closely packed and pressed up against the axis. Moreover, in *Boeckhia*, *Willdenovia*, and some other genera of this order, where the female flowers are solitary and placed upon or near to the extremity of the axis, and where in consequence the flowers are not subject to compression, the florets have not the flattened form that they have in *Restio*. The same rule applies to species of *Elegia*, *Lepyrodia*, and in fact to all wherein, from whatever cause, no pressure is exerted on the flowers.

The flowers themselves vary much in size in reference to the bracts, sometimes even exceeding the latter organ. When the capsule is ripe, the florets are necessarily altered in form and become more or less spheroidal. The florets are sessile within the bracts, or placed on very short stalks, in which latter case the inflorescence is not strictly spicate, though it would in practice be an unnecessary refinement to consider the inflorescence as other than a spike.

Each flower or floret (I use the two words indifferently in this case) consists of a perianth of six, or rarely of four glumes, arranged in two rows. The outer series consists of three pieces, placed in such a manner that one is central and anterior or next to the bract, and two lateral and somewhat posterior: the anterior one is usually flat or only slightly convex; the two lateral ones are conduplicate, boat-shaped, and marked in the centre of the dorsal surface by a projecting central nerve or carina, which is very generally clothed with woolly hairs. The three inner glumes alternate in position with the outer ones, and usually resemble the anterior glume in shape, but are of thinner texture. In some species, as *R. triticeus*, the inner glumes are slightly coherent at the base, in others each glume is thickened at the lower end. In the female flowers, especially of the two-styled section, it often

* Cfr. A. Braun, Nov. Act. Acad. Nat. Cur. xv. p. 2.

happens that the two inner lateral glumes have their margins somewhat involute and wrapping round the style, while the posterior one remains flat. In form, relative size, texture, colour, &c., these glumes vary considerably in different species, and afford good distinguishing characteristics. In all cases they are "persistent" around the ripe fruit, and sometimes "accrescent." The inner lateral glumes of *R. setiger* present a peculiarity which is worthy of notice, and which consists in the existence on the middle of their inner surface of a cushion-like pad of cellular tissue; the central posterior glume has only a very small central thickening, but both its edges are rolled inwards around the style. It would seem as if these excrescences, conjoined with the infolded margins of the glumes, must serve some special purpose in relation to the fertilization of the plant, but without an examination of fresh specimens it would be idle to speculate on this point. The growth in question will remind the observer of the glands on the outer surface of some of the segments of the perianth in *Rumex*.

In *R. bifurcus*, N. ab E. MSS., there is between the inner glumes and the stamens a small membranous lobed cup or disk, which may possibly represent a row of abortive stamens outside those which are usually present, and which it will be remarked are opposite to the inner glumes; if the disk, to which reference has just been made, be really the representative of an outer series of stamens, then the symmetry of the flower would be restored.

The male flowers have usually three hypogynous stamens placed opposite to the inner glumes, as just stated, but in *R. tenuissimus* there are but two, while in some of the Australian species there are six, thus completing the floral symmetry. The filaments are generally flattened and ribbon-like, attached by their upper ends to the back of the anthers a little above their base, so that the latter are described as peltate in spite of their erect, not horizontal, position. In the young flowers the filaments do not greatly exceed the anthers in length, and thus the whole of the stamen is included within the glumes; but after, very rarely before, the bursting of the anther, the filament lengthens, so that ultimately the anther projects beyond the glumes. I have never observed unopened anthers protruding from the perianth.

In form the anthers are linear or oblong, often surmounted by a small mucro, which originates just below the apex on the dorsal surface as in the sheaths and bracts.

The dehiscence of the anthers takes place lengthwise along a central suture, and thus exposes a single cavity. The anthers are

generally yellow on the ventral surface, reddish brown or purple on the dorsal aspect.

The pollen consists of separate oblong or spheroidal cells, smooth on the outer surface, and each provided with a single furrow.

In the three-styled section a rudimentary pistil (*pistillodium*) is found in the centre of the male flower, its three lobes alternating with the stamens and each surmounted by a rudimentary style.

The perianth in the female flowers resembles that of the male in all important particulars. Those species that are provided with three styles have also three antherless filaments (*staminodia*) within the inner glumes. The ovary is generally oblong or roundish, compressed from back to front, one-, two-, or three-celled; in the latter case the three carpels alternate with the stamens, and are placed opposite to the outer segments of the perianth, so that two carpels are posterior or next to the axis, while one is anterior or next to the bract. In Grasses the theoretical position of the carpels is exactly the reverse of this, the odd carpel being in that family posterior*. In point of size, the ovary itself is usually considerably shorter than the glumes, but the styles by which it is surmounted usually project beyond the perianth.

The styles vary in number from one to three. In those cases where there is but a single style, it is generally divided halfway down into two linear recurved branches, with feathery stigmatic hairs on the inner surface. Two distinct styles are rarely met with. When there are three styles, the ovary is generally inversely conical in form, and the styles project one from each of its upper corners. In a few species the base of the style is dilated into a yellow "stylopod" surmounting the top of the ovary, e. g. *R. setiger*. It has been proposed by Kunth† to separate the three-styled species from the rest and to form them into a new genus, a proceeding in which I am not disposed to concur, as it would break up a tolerably natural easily defined group into two less sharply limited divisions.

The fruit is capsular, one-, two-, or, very rarely, three-celled, dehiscing longitudinally along the edges of the carpels. Its form varies according to the presence of all its constituent carpels, or the abortion of one or more of them. It is surmounted in all cases by the rudiments of the styles.

There is usually but a single seed, occupying the whole of the

* See a paper of Nees von Esenbeck's in 'Linnæa,' v. p. 680, wherein a tricarpellary Grass is figured and described.

† Enum. iii. p. 397, adnot.

interior of one compartment of the fruit, from the upper and inner angle of which it is suspended by a very short funiculus; in form it is usually oblong, obscurely three-sided, slightly pointed at the upper end, flattened and somewhat quadrangular below. The testa is cartilaginous, greyish in colour, usually covered with minute pits, between which are interspersed purplish spots; in other cases the testa is studded with small whitish tubercles, giving the seed the aspect of being studded with minute pearls.

The perisperm is very copious, white, horny or somewhat farinaceous.

The embryo is a small lenticular fleshy mass placed in a little socket, at that end of the seed most remote from the hilum.

Teratology.—All the Restiaceæ appear to be subject to the occasional presence of bud-like aggregations of scales, like the bracts, but destitute of flowers. They are frequently found replacing the true inflorescence, and may be arranged in spikes or panicles. They are by no means confined to the inflorescence or to the fertile culms, but may be met with proceeding from the axils of the sheaths of the stem, or in the angles between two diverging branches. The scales in these instances are generally closely packed, but occasionally the central axis lengthens, and then the scales become separated by greater or less intervals one from another. These growths are of similar nature to those that occur in the so-called Rose Willows and other plants. Monœcious specimens sometimes occur, as has been before stated. In one instance only have I seen a truly hermaphrodite flower of *Restio*, and this occurred in a fragment of an undetermined species. In *Lepyrodia hermaphrodita* this condition is common, and it also occurs, though very rarely, in other genera.

Minute Anatomy.—Sections of the root of *R. triflorus*, made in various directions, exhibit on the outer surface an epidermal layer destitute of stomata; subjacent to this are three or four rows of large, loosely-packed oblong cells, polygonal on cross section, and having slightly thickened walls; these again encircle a thick layer of pitted liber-cells, which are of a deep-brown colour. In the centre is a cylinder of wood-cells, with thick walls and few, if any, pits; intermingled with these are a small number of slit-marked ducts.

The structure of the rhizome is very similar to that of the root; there is a similar thick dark-brown epidermis covering a layer of very large dark-coloured liber-cells. The great mass of the root-stock, however, consists of oblong or polygonal, thick-walled,

pitted cells, mingled with which in great abundance are pitted and barred ducts in groups of three to six, each group of vessels forming a centre around which the cells just mentioned are disposed.

Culm.—An examination of the structure of the stem of *R. ferruginosus*, Link, reveals an epidermis of somewhat quadrangular cells, destitute of chlorophyll, and having a few scattered stomata, protected by two oval guard-cells. In old stems the epidermal cells increase greatly in size, and become very thick-walled, especially on the outer side. Many of them contain masses of a dark-brown substance, probably of a resinous nature. Not unfrequently the outer wall of these resin-bearing cells breaks away, leaving a funnel-shaped cavity, which being open externally becomes filled with dirt. These funnel-shaped cells give a very peculiar appearance to the microscopic sections of the old culms (Pl. XIV. figs. 1, 2).

Beneath the epidermis in the young culms there is a series of small spherical cells containing chlorophyll (Pl. XIV. figs. 3, 4), but as they increase in age their size and form become greatly changed, their chlorophyll disappears, and thus at length in the old culms they form a thick spongy layer of flattened elongated cells, whose long diameter is at right angles to that of the culm (Pl. XIV. figs. 1, 2).

Succeeding this spongy layer, going from without inwards, is another zone of cellular tissue, consisting of three or four rows of oblong somewhat quadrangular cells, whose long diameter is parallel to that of the culm. These enclose a broad zone of thick-walled liber-cells; interspersed among these latter are numerous scattered fibro-vascular bundles. Next in order is a cylinder of cellular tissue, whose constituent cells are large, oblong or somewhat polygonal, and pitted, thus greatly resembling the pith-cells of an Exogenous plant. These pith-like cells contain numerous small oblong starch-grains, and some of them also enclose dark-brown resinous matter like that of the epidermal cells. Traversing this pith-like cylinder are scattered bundles of vascular tissue, consisting of wood-cells and barred ducts. Pitted ducts and spiral vessels seem to be entirely absent (Pl. XIV. figs. 1, 2).

The sheaths present from without inwards an epidermal layer of large, somewhat cubical cells, thickened on the outer wall, and perforated here and there by stomata, like those of the culm. Subjacent to this is a quantity of cellular tissue, the cells of which vary considerably in size, but are mostly oblong and six-sided.

The fibro-vascular bundles traverse the cellular tissue at intervals, in a straight direction from the base of the sheath upwards. Their constitution is exactly like that of the bundles of the stem.

The epidermis on the inner side of the sheath consists of smaller, thinner cells than on the outside; they are, moreover, compressed from back to front, and are not interrupted by stomata.

The bracts and glumes are similar in structure to the sheaths.

The hairs that invest the carina of the glumes are long, flattened, tortuous, irregularly branched or compound hairs. The stigmatic hairs are in tufts, in appearance like those just mentioned, but smaller and unbranched.

Arrangement of Species.—With reference to the grouping of the species, great difficulty and uncertainty must exist for the home observer, in the due matching of the sexes. In many cases one sex only is known, while in others the male and female plants are so different in appearance that they have been described as constituting different species. For these reasons I have, in the following arrangement, deviated but little from that published by Kunth, which is, I believe, on the whole the best that has been proposed. When the male and female plants of all the species are known with certainty, a more natural arrangement can doubtless be made by grouping the species according to the form and arrangement of the male and female spikelets.

I have endeavoured to group the species in a manner that may be practically useful to botanists. No one knows so well as myself the defects and shortcomings that pervade this arrangement, but after numerous trials the one adopted has seemed the best. I first of all take Kunth's first section, or true Restios, in which there are two connate styles. The male flowers of this section are readily recognizable by the absence of a rudimentary pistil or *pistillodium.* The presence or absence of staminodia in the female flowers, or of pistillodia in the male flowers, I find to afford valuable characters from the constancy of the distinguishing marks so afforded. The next subdivision is according to the presence of one, two, or of more florets in the ripe female spikelets. This group is again subdivided into those which have loose sheaths and those in which those organs closely wrap around the culm. In practice I find this to afford valuable characters, though apparently of little physiological importance. The succeeding groups are established according to the arrangement of the inflorescence in the male plants. I have experienced greater difficulty in subdi-

viding the three-styled section, which Kunth proposed as a new genus, but which, from reasons already assigned, I prefer to keep as a section of *Restio*. On the whole, the most satisfactory subdivision of this group appears to be one founded on the form of the culms.

As to the species themselves, I have commented on them in their several places, and here need not say more than that I have, with as much care as I have been able to bestow, examined them all again and again, rectified and adjusted their synonymy, and reduced and combined some forms according to the best of my judgment, on the evidence before me. At the same time I have ventured to propose the establishment of some new species, hitherto, as I believe, undescribed, or indicated (without descriptions being given) by Nees von Esenbeck in Dr. Sonder's herbarium. Of these I have given rather lengthened diagnoses, feeling that shorter ones would be even more unsatisfactory than those I have drawn up.

CONSPECTUS SPECIERUM.

SECT. I. *Styli duo connati, rarissime distincti. Staminodia nulla. Pistilli rudimentum (in flor. masc.) nullum.*

A. *Spiculæ femineæ pluriflioræ.*

* *Vaginæ culmeæ laxæ.*

† *Spiculæ masculæ approximatæ vel glomeratæ, femineæ solitariæ vel aggregatæ.*

R. SPRENGELII, *Mast. MSS.*—R. squarrosus, *Spreng. Syst. Veg.* i. p. 186. n. 48 (1826), nec *Lamarck*; *Nees ab Esenbeck, Linnæa*, v. p. 643; *Steudel, Flora*, 1829, i. 133. n. 6.—R. Lucæanus, *Kunth, En.* iii. p. 385 (1841), quoad pl. masc.—? R. vaginatus, *Thunb.* (fide *Steudel*, sed vix).—? R. cuspidatus, *Thunb. Fl. Cap.* i. p. 87.

Hab. Pr. B. Sp. Ex. s. sp. ♂. False Bay, *Robertson*, in herb. Mus. Brit.! In campis arenosis lapidosis sub monte Tabulari (Nov., Dec.); ad Dorsum Leonis inter frutices (Junio); *Ecklon*, n. 84 pro parte!; *Zeyher*!; *Sieber*!; *Harvey*, n. 388 *b*!; *Milne*, 223!; *Thom*!; *Bergius*! ♀. *Eck. Un. It.* 848!; *Eck. et Zeyh.* 77. 9!; *Drège*, 44!; Wynberg, *Wallich*!

Nomen mutavi ob antiquiorem *R. squarrosum* cl. Lamarck.

Plantæ femineæ adhuc indescriptæ characteres adjicio. *Culmus vaginæque* ut in mare. *Spiculæ* 2–3 in apice ramorum approximatæ, erectæ, oblongo-lanceolatæ, plurifloræ. *Bracteæ* arcte imbricatæ, ovato-lanceolatæ, superne hyalino-membranaceæ, sub apice mucro-

nato subaristatæ (aristis patulis), flores ovato-lanceolatos, breviter pedicellatos, 2–3plo superantes. *Glumæ externæ* laterales duo, ovato-lanceolatæ, acutatæ, naviculari-conduplicatæ, carinatæ, carina ferrugineo villosa. *Gluma intermedia* antica ovato-lanceolata, planiuscula, dorso superne ferruginea, lateralibus vix brevior. *Glumæ internæ* 3, minores, tenuiores, ovatæ, acutæ; postica plana; lateralium margines superne involuti. *Staminodia* nulla. *Ovarium* oblongum, complanatum, biloculare, stylo elongato, superne in ramos stigmatosos duo exsertos curvatos diviso superatum. *Capsula* bilocularis (an semper?), rotundata, lenticulari-complanata, coriacea, spadicea, marginibus longitudinaliter dehiscens. *Semina* solitaria vel duo magna, oblongo-obtusa, trigona; testa cartilaginea, albida, impresso-punctulata, maculis parvis violaceis notata.

Nees, in 'Linnæa,' v. p. 643, says, in reference to the synonym *R. cuspidatus*, Thunb., "*R. cuspidatus* Thunb., quoad descriptionem, sane nimis incompletam, nulli cognitorum proprius quam isti accedere videtur."

R. OCHREATUS, *Kunth, En.* iii. p. 385. n. 3; *Steud. Synops.* ii. p. 250. n. 10.—Calopsis peronata, *Kunth, l. c.* p. 426, quoad plant. masc.—R. Lehmanni, *Nees, MSS. in herb. Sonder*, pl. masc.

Hab. Pr. B. Sp. Ex. s. sp. ♀. *Drège*, 47 pro parte!, 2505!; *Harvey*, 388 *c*! ♂. *Drège*, 1623!, 42!; Onderbokkefeld, *Eck. et Zeyh.* 1207!

Plantæ masculæ *culmus vaginæ*que ut in feminea. *Spiculæ* 00 in paniculam densam, ramosam, terminalem, 2–3-pollicarem dispositæ. *Pedunculi* breves, singuli spatha vaginæformi suffulti; pedicelli brevissimi, nudi. *Spiculæ* singulæ erectæ vel patentes, nonnunquam curvatæ, ovato-acutæ, 3–4 lin. long., 1–1½ lin. lat. *Bracteæ* omnes fertiles, undique arcte imbricatæ, oblongæ, recurvato-acuminatæ, coriaceæ, ferrugineæ, superne pallidiores, vix membranaceæ, flores oblongo-lanceolatos parum superantes. *Perianthium* biseriale, sexglume, *glumis externis* duo lateralibus oblongo-acutis, naviculari-conduplicatis, ad carinas ferrugineo villosis, rigidiusculis; *gluma intermedia* antica, subæquali, oblonga, arcuata, dorso medio maculis ferrugineis notata; *glumis internis* 3, brevioribus, inter se æqualibus, oblongis, subhyalinis. *Filamenta* ligulæformia, albida. *Antheræ* ovatæ, acutatæ, antice flavidæ, postice ferrugineæ, dorso peltatim affixæ, demum exsertæ. *Pistilli* rudimentum nullum.

R. FRATERNUS, *Kunth, l. c.* 386. n. 6.

Hab. C. B. S. Ex. s. sp. *Drège*, 45!, 1623 pro parte!

Planta feminea adhuc incognita, nisi forte sub diverso nomine descripta.

R. PAUCIFLORUS, *Poir. Enc.* vi. 168; *Kunth, En.* iii. p. 412. n. 49; *Steudel, Synops.* ii. p. 254.

Planta feminea adhuc incognita.

R. GLOMERATUS, *Thunb. Fl. Cap.* 88.
An hujus sectionis?

R. CUSPIDATUS, *Thunb. Fl. Cap.* 87.
An hujus sectionis?

R. SIMPLEX, *Thunb. Diss.* n. 15.
An huc recte referenda?

†† *Spiculæ masculæ in paniculas elongatas dispositæ.*

R. FERRUGINOSUS, *Link, in herb. reg. Berol. fide Kunth, En.* iii. p. 393. n. 20, absque pl. femin.—R. ameles, *Steud. Synops.* ii. p. 252. n. 30.
Hab. Pr. B. Sp. Ex. s. sp. ♂. *Ecklon*!; *Drège*, 1619 *b*!, 1620 pro parte!; Table Mountain (Julio); *Krauss*; (*Cayley*!) *Harvey*!
V. v. cult. in hort. bot. Oxon. sub nomine *Willdenoviæ teretis.*

Drège's specimens distributed under n. 1620, considered by Steudel as the type of a new species, do not differ from *R. ferruginosus*, except in the more elongated form of the branchlets and the thinner texture of the bracts, glumes, &c.

R. ELATUS, sp. n. Culmo (3–4-pedali) basi decumbente, tereti (crassitie pennæ anserinæ), versus medium parum dichotome ramoso, ramisque elongatis, erectis, compressiusculis, nitidis, viridescentibus, minutissime impresso-puncticulatis, aphyllis; vaginis subpollicaribus, laxe patentibus, ovatis, coriaceis, sub apice obtusiusculo hyalino membranaceo acuminatis: spiculis masculis 6–8, in apice ramulorum parum approximatis et in paniculam simplicem disticham dispositis, singulis cylindraceo-lanceolatis, arcuatis, erectis v. patentibus, breviter pedicellatis (6–7 lin. long., vix 1 lin. lat.); bracteis arcte imbricatis, oblongo-acutis, coriaceis, sub apice obtuso membranaceo subulato-mucronatis, flores oblongos vix superantibus; glumis externis lateralibus duo, oblongis, obtusis, naviculari-conduplicatis, ad carinas ferrugineo villosis; gluma antica intermedia subæquilonga, oblonga, membranacea, dorso medio ferrugineo villosa; glumis internis tribus, quam externæ dimidio brevioribus, illisque latioribus, membranaceis; antheris exsertis, ovatis, apiculatis, ferrugineis: spiculis femineis 4–6, in apice culmi, erectis, approximatis, sessilibus v. breviter pedicellatis, singulis ovato-oblongis (3–5 lin. long., 1–2 lin. lat., pluriflor.); bracteis ut in mare, infimis vacuis, ceteris fertilibus, flores oblongos parum superantibus; glumis externis late ovatis, acutis, lateralibus duo conduplicatis, villoso carinatis, antice approximatis et glumam intermediam celantibus; glumis internis 3, dimidio brevioribus, membranaceis, dorso medio ferrugineis, lateralium marginibus superne parum involutis; staminodiis nullis; ovario oblongo, compresso, biloculari, stylo crasso tereti (superne in ramos duo stigmatosos curvatos exsertos diviso) superato; capsula ——.
Hab. C. B. S. Ex. s. sp. *Drège*, 93!, ♂ et ♀.

R. SUBVERTICILLATUS, *Mast. MS.* Culmo erecto, tereti (2–3-pedali), ad vaginas subverticillatim ramoso, ramisque filiformibus, erecto-patentibus, crassiusculis, iterum fasciculatim vel dichotome ramulosis, foliaceis vel aphyllis; vaginis culmeis laxis, ovatis, acutis, coriaceis, semipollicaribus et ultra, rameis ellipticis, superne membranaceis, sub apice bilobato hyalino subulato-mucronatis, mucrone in folium lineare arcuatum nonnunquam producto: spiculis masculis 6–8, in apice ramulorum, in paniculam simplicem disticham parum approximatis, singulis erectis vel patentibus, cylindraceo-lanceolatis, rectis v. leviter arcuatis (4–5 lin. long., vix 1 lin. lat.); bracteis arcte imbricatis, ovatis, acutis, dorso convexis, ferrugineis, coriaceis, sub apice membranaceo mucronulatis, flores paulo superantibus; glumis externis lateralibus duabus oblongis, obtusiusculis, naviculari-conduplicatis, ad carinas ferrugineo villosis; gluma intermedia antica planiuscula, oblonga, ferruginea, dorso medio parum ferrugineo villosa; glumis internis 3, brevioribus, oblongis, marginibus superne parum involutis: spiculis femineis 1–3, in apice ramulorum sessilibus pedunculatisve, erectis, ellipticis, demum subclavatis, pyriformibus (1–3 lin. long., 1–2 lin. lat.), plurifloribus; bracteis inferioribus vacuis, ceteris fertilibus, flores ovato-oblongos vix superantibus; glumis 2 externis lateralibus late ovatis, acutis, rigidis, coriaceis, ferrugineis, ad carinas dense ferrugineo villosis, glumam intermediam conformem planiusculam celantibus; glumis internis 3, minoribus, tenuioribus, lateralium marginibus superne involutis, postica planiuscula; ovario rotundato, compresso, biloculari, stylo elongato superne bifido superato; capsula oblique ovata, uniloculari, monosperma.

Ischyrolepis subverticillata, *Steudel, l. c.* p. 249, quoad plantam femineam.—R. ferruginosus, *Link fide Kunth*, quoad pl. fem.—R. casuarinæformis, *N. ab E. in herb. Sonder.*

Hab. C. B. S. Ex. sp. s. ♂. 1620 pro parte, *Drège*!; Stellenbosch, *Harvey*!; *Ecklon*!; *Zeyher*! ♀. *Drège*, 1!; *Harvey*!; *Eck. et Zeyh.* 61. 5!

V. v. cult. in hort. Angl. sub nom. *Willdenoviæ teretis.*

Steudel separated the female plant (the male was unknown to him) from Link's *R. ferruginosus*, and made it the type of a new genus, differing mainly from *Restio* in the possession of four instead of six glumes to the perianth, in the thicker glumes, and in the whorled condition of the branches. In all the specimens that have come under my observation there are six glumes, the two outer lateral ones so much larger, however, than ordinary, that they touch by their anterior margins, and hence almost wholly conceal the intermediate glume. In the male plant the form of the glumes is more obtuse and their texture less rigid than in the female plant; so that in these particulars the male plant bears very great resemblance to *R. ferruginosus*, from which, however,

it may be distinguished by the verticillate ascending, not spreading branches. Both the species just named vary a great deal in their degree of luxuriance and in the absence or presence of leaves.

** *Vaginæ culmeæ arctæ.*

R.? SQUARROSUS, *Lam. Ill.* t. 804. f. 1.—R. echinatus, *Kunth, En.* iii. 384.

Hab. C. B. S. Ex. sp. s. ♂. *Drège*, 49! ♀ hucusque incognita.

Lamarck's figure evidently belongs to the plant subsequently referred to *R. echinatus* by Kunth, which must now be abandoned. Lamarck's name has precedence over that of Sprengel (see *R. Sprengelii*, Mast.). The female plant is not yet known; it may probably, when discovered, turn out to be a species of *Hypodiscus* rather than of *Restio.*

R. SETIGER, *Mast. MS.*—R. setiger, *Kunth, En.* iii. 385, quoad pl. femin.—R. fuirenoides, *Kunth, l. c.* 386, pl. masc.

Hab. C. B. S. Ex. sp. s. ♀. *Drège*, 2503!, ♂ 2504!

The two forms here associated appear at first sight sufficiently distinct; but a more careful examination will show that the only points of difference between the two consist in this, that the male spikelets are smaller than the female, and are moreover very numerous and densely crowded together, while in the female plant the spikelet is comparatively large and solitary or geminate. In all other essential points the two plants agree, and hence I have ventured to combine them into a single species.

R. DIGITATUS, *Thunb. Prod.* p. 15; *Diss.* p. 18. n. 21; *Fl. Cap.* i. p. 88. n. 25; *Spreng. Syst.* i. p. 186. n. 34; *N. ab E. Linnæa,* v. p. 638; *Kunth, En.* iii. p. 410. n. 46.

Var. β. Glumis latioribus, culmo crassiore, *N. ab E. l. c.*—R. obtusissimus, *Steud. Synopsis*, ii. p. 252. n. 36.

Hab. C. B. S. Ex. sp. s. ♂. Musenberg, *Ecklon*, n. 41!—Var. β. Hottentotshollandberg (April), *Eck.* n. 18!; *Drège*, 22!

The variety β, considered by Steudel to form a distinct species, differs from Thunberg's plant in having broadly oblong obtuse glumes. Probably this is the normal condition of the species, the linear filiform state being simply the result of arrested growth.

R. CONCOLOR, *Steudel, Synopsis*, ii. p. 251. n. 22.

Hab. C. B. S. *Drège*, n. 31.

"*R. scopario* affinis sed certe diversus," *Steud.*

R. SCHŒNOIDES, *Kunth, En.* iii. p. 391. n. 16, quoad pl. fem.

Hab. C. B. S. Ex. sp. s. ♂. *Eck.* 84 ex parte!; ♀. *Drège*, n. 50!

Plantæ masculæ adhuc indescriptæ notas adjicio. *Culmus* ut in feminea. *Spiculæ* 3–4 in apice culmi parum remotæ, singulæ ovato-acutæ, spatha vaginæformi spiculas vix æquante suffultæ; pluriflorae. *Bracteæ* arcte imbricatæ, ovatæ, subulato-acuminatæ, dorso superne impresso-punctulatæ, marginibus superne membranaceis, flores arcuatos acutos superantes. *Glumæ externæ* 3, acutatæ, subæquales, vix coriaceæ, laterales conduplicatæ, ad carinas ferrugineo villosæ; *glumæ internæ* 3, parum breviores, conformes, subhyalinæ. *Stamina* 3, filamentis complanatis, albidis. *Antheræ* ——. *Pistilli* rudimentum nullum.

In this species the style is deeply bipartite, an unusual circumstance in the genus.

R.? OBLONGUS, sp. n. Culmo pedali, basi decumbente, compressiusculo, spongioso (crassitie pennæ gallinaceæ), cinnamomeo, albo tuberculato, versus basin subfasciculatim dichotomeque ramoso, ramisque erecto-patentibus, flexuosis, elongatis, compressis, aphyllis; vaginis nisi ad ramificationes arctis, unguicularibus, ellipticis, coriaceis, tuberculatis, apice mucronato-aristatis: spiculis masculis in apice ramulorum 2–3, approximatis, sessilibus pedicellatisve, singulis oblongis, spatha aperta lanceolata longe acuminata coriacea ad margines superne membranacea suffultis (3–4 lin. long., 1–2 lin. lat.); bracteis undique laxe imbricatis, lanceolatis, ferrugineis, maculatis, flores oblongos arcuatos superantibus; glumis externis oblongis, arcuatis, pergamentaceis, ferrugineis, lateralibus 2, conduplicatis, carinatis, carina (villo delapso?) glabra; glumis internis 3, conformibus, externis vix minoribus, tenuioribus, lateralium marginibus superne parum involutis; staminibus 3, antheris oblongo-ovatis.—An hujus sectionis?

Hab. C. B. S. Ex. sp. s. *Drège*, 65!

Feminea adhuc ignota.

R.? CRINALIS, sp. n. Culmo decumbente, filiformi, tereti, pedali, prope basin dichotome ramoso, ramisque erectis, ascendentibus, cinnamomeis, crasse tuberculatis; vaginis arctis, ellipticis, fuscis, coriaceis, tuberculatis, sub apice subulato-mucronatis, mucrone nonnunquam in setam longissimam producto: spiculis masculis in apice ramulorum approximatis, sessilibus v. pedicellatis, singulis oblongo-ovatis (3–4 lin. long., 1–2 lin. lat.), spatha aperta lanceolata apice longe setacea suffultis; bracteis laxe imbricatis, lanceolatis, submembranaceis, medio ferrugineis, infimis 2–3 vacuis, ceteris flores brevissime pedicellatos oblongo-lanceolatos paulo superantibus; glumis externis lateralibus lanceolatis, naviculari-conduplicatis, carinatis, carina (villo delapso?) glabra, gluma intermedia antica, conformi, dorso (præcipue versus basin) ferruginea; glumis internis 3, parum minoribus, tenuioribus; filamentis albidis; antheris exsertis, flavidis; pistilli rudimento nullo.

Hab. C. B. S. Ex. sp. s. *Drège*, 11!

This plant has much of the appearance of *R. oblongus*, but differs

in its smaller stature, cylindrical stems, the long threads that terminate the sheaths, the lanceolate glumes, &c. I retain this and the preceding in the genus *Restio* until the discovery of the female plants may definitely decide the question whether or not they are properly members of this genus.

·R. SCOPARIUS, *Kunth, En.* iii. p. 390. n. 15; *Steudel, Synopsis,* ii. p. 251, ♀ tantum.

Hab. C. B. S. Ex. sp. s. ♂. *Drège,* 2495! ; ♀. *Drège,* 9450! ex parte.

Plant. masc. *Culmus vaginæ*que ut in feminea. *Spiculæ* in apice ramulorum solitariæ, erectæ, lineari-lanceolatæ, 4–5 lin. long., vix 1 lin. lat. *Bracteæ* undique arcte imbricatæ, oblongæ, coriaceæ, sub apice obtusiusculo membranaceo mucronato-aristulatæ, superiores aristula destitutæ. *Flores* lanceolati, bracteis dimidio breviores. *Glumæ externæ* oblongo-lanceolatæ, laterales duo conduplicatæ, villoso-carinatæ. *Glumæ internæ* 3, oblongæ, dimidio breviores, tenuiores. *Filamenta* exigua. *Antheræ* inclusæ, lineares, flavidæ, mucronulatæ.

An sequentis forma exilis?

R. LANIGER, *Kunth, En.* iii. p. 386. n. 8; *Steudel, Synops.* ii. p. 250. n. 14, ♂ tantum.

Hab. C. B. S. Ex. sp. s. ♂. *Drège,* 51! ; ♀. *Drège,* 36!, 2496!

In planta feminea hactenus indescripta adsunt *culmi steriles* spithamæi, teretes, exiles, medio dichotome ramosi, ramique elongati, olivacei, albo lepidoti, iterumque ramulosi, ramuli ultimi erecti, curvati, filiformes. *Vaginæ culmeæ* parvæ, arctæ, coriaceæ, superne membranaceæ, sub apice hyalino breviter foliaceo mucronatæ. *Culmi fertiles* erecti, sesquipedales, crassitie pennæ gallinaceæ, basi spatio 2–3-pollicari, vaginis ellipticis obtusis mucronulatis coriaceis spadiceis nitidis obtecti, versus medium dichotome ramosi, ramique erecti, curvati, olivacei, tuberculis parvis albidis obsiti. *Vaginæ* nisi ad ramificationes arctæ, oblongo-acutæ, coriaceæ, fuscæ, sub apice membranaceo mucronatæ, plerumque squamam alteram dorso bicarinatam, ad carinas villosam, amplectentes. *Spiculæ* in apice ramulorum solitariæ, erectæ, ovatæ, plurifloræ, 3–4 lin. long., 2 lin. lat. *Bracteæ* arcte imbricatæ, ovatæ, coriaceæ, castaneæ, sub apice obtusiusculo membranaceo acuminato-mucronatæ, flores maturos oblongos stipitulatos vix æquantes. *Glumæ externæ* oblongo-lanceolatæ, rigidiusculæ, pallide ferrugineæ, laterales duæ naviculari-conduplicatæ, ad carinas ferrugineo villosæ; *gluma intermedia* antica, dorso medio superne nervo ferrugineo notata: *glumæ internæ* 3, parum breviores, latiores, conformes, ad margines involutæ. *Capsula* oblique ovata, compressa, abortu unilocularis, monosperma, castanea, superne flavida, styli brevis teretis bifidi vestigiis coronata. *Semen* magnum, trigonum, obtusum; testa cartilaginea, grisea, impresso-punctulata, purpureo maculata.

R. VILIS, *Kunth, En.* iii. p. 389. n. 13; *Steud. Synops.* ii. p. 251. n. 19.
Hab. C. B. S. Ex. sp. s. ♂ et ♀. *Drège,* 2476!

R. INTERMEDIUS, *Kunth, En.* iii. p. 388. n. 12; *Steud. Synops.* ii. p. 251. n. 18.
Hab. C. B. S. Ex. sp. s. ♂ et ♀. *Drège,* 2475! ♀. *Drège,* 197!, n. 81 pro parte!

R. vilis and *R. intermedius* are sometimes difficult to distinguish one from the other; in the latter plant the bracts and glumes are less acutely pointed than in *R. vilis,* and the female spikelets have usually a smaller number of perfect flowers. *R. intermedius* seems to vary considerably in the size of its spikelets and glumes.

R. VENUSTULUS, *Kunth, En.* iii. p. 388. n. 11; *Steud. Synops.* ii. p. 250. n. 17, ♂ tantum.
Hab. C. B. S. Ex. sp. s. ♂. *Drège,* 9450! ♀. *Drège,* 1608!
Plantæ femineæ *culmus* simplex vel parce ramosus, pro ceteris ut in mare. *Spiculæ* in apice culmi 1–4, spicatim dispositæ, juniores cylindraceo-lanceolatæ, fructiferæ late ovatæ, acutæ, 3–5 lin. long., 1–2 lin. lat. *Bracteæ* arcte imbricatæ, oblongo-lanceolatæ, coriaceæ, nitidæ, striatæ, sub apice parum membranaceo haud hyalino subulato-mucronatæ, infimæ vacuæ, ceteræ fertiles flores lanceolatos pedicellatos superantes. *Glumæ externæ* ovato-lanceolatæ, rigidiusculæ, laterales duæ naviculari-conduplicatæ, ad carinas ferrugineo villosæ; *glumæ internæ* 3 vix breviores, conformes, tenuiores, postica plana, laterales ad margines superne parum involutæ. *Ovarium* oblongum, compressum, biloculare, stylo tereti bifido exserto superatum. *Capsula* oblique ovata, abortu unilocularis, coriacea, castanea, ad margines viridis, styli vestigiis coronata. *Semina* ——.

R. SUBFALCATUS, *Nees, in herb. Sonder.* Culmis sterilibus spithamæis, basi decumbentibus, squamisque laceratis sphacelatis obsitis, superne flexuosis, erectis, teretibus (crassitie pennæ corvinæ), infra medium dichotome ramosis, ramisque arcuatis, ascendentibus, superne ramulosis, ramulis curvatis, interdum fasciculatis, foliiferis; culmis fertilibus duplo longioribus, minus ramosis, plerumque aphyllis, punctulatis, viridescentibus vel stramineis; vaginis arctis, pollicaribus, ellipticis, coriaceis, striatis, ferrugineis, sub apice hyalino membranaceo mucronato-aristatis: spiculis masculis 00, erecto-patentibus, in paniculam terminalem parce diffusam dispositis, singulis cylindraceo-lanceolatis, arcuatis (3–4 lin. long., 1 lin. lat.); bracteis arcte imbricatis, ovato-oblongis, coriaceis, sub apice membranaceo subulato-mucronatis, flores arcuatos ovato-acutos duplo superantibus; glumis externis oblongo-acutis, lateralibus 2, conduplicatis, ad carinas ferrugineo villosis, intermedia antica, conformi, dorso nervo medio ferrugineo notata; glumis internis 3, parum brevioribus, conformibus, hyalinis; antheris demum exsertis, oblongis, mucronulatis: spiculis femineis 3–4, ovatis, pluri-

floris, in apice culmi approximatis, singulis (2–3 lin. long., 1 lin. lat.) spatha aperta ovato-acuta longe aristata munitis; bracteis glumisque externis ut in mare; glumis internis 3, quarum duæ laterales minores ad marginem anticam involutæ; ovario subgloboso, compresso, biloculari, stylo tereti (superne in ramos duos stigmatosos curvatos exsertos diviso) coronato; capsula ——.

R. subfalcatus, *N. ab E. MS. in herb. Sonder. absque descriptione.*—R. dichotomus, *Thunb. fide Nees in herb. Sonder. sed vix.*

Hab. C. B. S. Ex. sp. s. Olifant's River. ♂ et ♀. *Ecklon,* 76! ♂. *Drège,* 75!; *Eck. et Zeyh.* 50!

Kunth refers Drège's n. 75 doubtfully to *R. vilis.* I have preferred to follow Nees's indication, and to constitute it a new species under the name assigned to it by him in Dr. Sonder's herbarium, but nowhere published. The male plant differs from *R. vilis,* Kunth, in its more robust habit, larger size of all its parts, in the more branched and spreading panicle, the curved spikelets, &c.; the female plant differs in the larger number and different form of the spikelets and in the more acutely pointed glumes.

R. PYCNOSTACHYUS, sp. n. Culmis cæspitosis, decumbentibus, erectis, teretibus, sterilibus spithamæis, infra medium dichotome ramosissimis, ramulis arcuatis, foliiferis, arbusculam pyriformem mentientibus, fertilibus simplicibus, aphyllis, duplo vel triplo longioribus, stramineis, impresso-punctulatis; vaginis arctis, ellipticis, coriaceis, ferrugineis, sub apice membranaceo aristatis: spiculis masculis 00, in paniculam erectam terminalem latam approximatis, singulis cylindraceo-lanceolatis, arcuatis (3–4 lin. long., vix 1 lin. lat.); bracteis arcte imbricatis, late ovatis, acutis, flores vix superantibus; glumis externis 3, oblongo-acutis, lateralibus conduplicatis, villoso carinatis; glumis internis conformibus, minoribus, membranaceis; filamentis complanatis, albidis; antheris oblongis, ferrugineis, mucronulatis, demum exsertis. Feminea ignota.

Hab. C. B. S. Ex. sp. s. ♂. *Drège,* 79!

In one of the specimens examined by me, the pyramidal tuft of leaf-bearing branchlets was borne on a long erect culm like the fertile one.

R. NEESII, sp. n. Culmis (sesquipedalibus) erectis, teretibus (crassitie pennæ gallinaceæ), basi vaginis ovatis castaneis coriaceis approximatis obtectis, infra medium dichotome ramosis, hisque erectis, ascendentibus, stramineis, minutissime impresso-punctulatis, aphyllis; vaginis culmeis arctis, oblongis, coriaceis, striatis, albo tuberculatis, ferrugineis, sub apice obtusiusculo fusco membranaceo mucronato-subaristatis: spiculis masculis 00, in paniculam densam cymosam terminalem unguicularem dispositis, singulis ovatis, erectis patenti-

busve, plurifloris (1 lin. long., vix ½ lin. lat.), spatha aperta brevi vaginæformi suffultis; bracteis arcte imbricatis, ovatis, coriaceis, ferrugineis, nigrescentibus, marginibus superne membranaceis, sub apice subulato-mucronatis, flores oblongos superantibus; glumis externis oblongis, obtusiusculis, lateralibus duabus conduplicatis, ad carinas ferrugineo villosis; glumis internis conformibus, externas paulo superantibus, dorso superne parum ferrugineis, membranaceis; filamentis complanatis, albidis; antheris lineari-lanceolatis, apiculatis. Plantæ femineæ culmo vaginisque ut in mare nisi magnitudine majoribus; spiculis 3–5 in paniculam latam simplicem terminalem dispositis, singulis ovatis, demum clavatis (2–3 lin. long., 1–2 lin. lat.), 2–3-flor.; bracteis arcte imbricatis, masculinis omnino similibus, nisi magnitudine majore substantiaque rigidiore; glumis externis oblongo-acutis, rigidiusculis, lateralibus conduplicatis, ad carinas ferrugineo villosis; glumarum interiorum longitudine eadem ac glumarum externarum, lateralium marginibus superne involutis, postica planiuscula; ovario oblongo, compressiusculo, stylo brevi tereti crasso bifido superato; capsula oblique ovata, uniloculari, ad latus rima longitudinali dehiscente, styli vestigiis coronata, glumis persistentibus obtecta.

Hab. C. B. S. Ex. sp. s. ♂. *Eck. et Zeyh.* 72. 11! ♀. *E. et Z.* i. 12!

At first sight the male plant greatly resembles some forms of *R. Gaudichaudianus*, Kunth; but it is readily distinguishable by the characters afforded by the sheaths, glumes, &c.

In Dr. Sonder's herbarium the male and female plants have attached to them the name of *R. bifurcus*, Nees von Esenb., in the handwriting of that botanist; but as that author has applied the same name to an entirely different species, in the before-mentioned collection, I venture to attach to the above-described plant a different appellation, and one which will be significant of the recognition of the plant as a distinct species by the learned author above named.

R. HELENÆ, sp. n. Culmis sterilibus pedalibus et ultra, decumbentibus, basi vaginis ellipticis coriaceis castaneis approximatis obsitis, infra medium dichotome ramosis, ramisque compressis, olivaceis, albo tuberculatis, iterum ramulosis, ramulis ultimis elongatis, flexuosis, ascendentibus; culmis fertilibus teretibus, 2–3-pedalibus, stramineis vel juventute olivaceis, superne parum ramosis, ramis dichotomis fasciculatisve; vaginis arctis, ellipticis, coriaceis, cuspidatis, ad margines superne membranaceis, vaginis ramularibus sub apice bifido membranaceo foliaceo-mucronatis: spiculis masculis pluribus, ad apicem culmi, in paniculam magis minusve ramosam approximatis, singulis cylindraceo-lanceolatis, erectis, arcuatis (4–5 lin. long., 1 lin. lat.), spatha aperta bracteiformi suffultis; bracteis arcte imbricatis, oblongis, acuminatis, coriaceis, ferrugineis, ad margines superne membranaceis,

flores oblongos superantibus; glumis externis oblongis, obtusis, chartaceis, lateralibus duabus naviculari-conduplicatis, ad carinas ferrugineo villosis, intermedia dorso medio superne nervo ferrugineo notata; glumis internis tribus parum brevioribus, latioribus, hyalino-membranaceis; filamentis complanatis, antheris denique exsertis: spiculis femineis ut videtur solitariis, erectis, cylindraceo-oblongis, plurifloris (8–10 lin. long., 1 lin. lat.); bracteis glumisque ut in mare, nisi magis acutis; glumis internis lateralibus ad margines superne parum involutis, postica plana; ovario rotundato, compresso, stylis duobus elongatis superato; capsula ——.

Hab. C. B. S. Ex. sp. s. ♂ et ♀. *Drège*, n. 1616.

Closely allied to *R. triflorus*, but readily distinguished by its larger size, the acuminate bracts, and obtuse glumes.

R. TRIFLORUS, *Rottb. Desc. Gram.* p. 3, t. 2. f. 2 (♂); *Thunb. Prod.* p. 15; *Diss.* p. 16. n. 16; *Fl. Cap.* i. p. 86. n. 17; *Spreng. Syst. Veg.* i. p. 185. n. 27; *Kunth, En. Plant.* iii. p. 391. n. 17, quoad pl. femineam.—R. dichotomus, *Thunb.* var. β. culmo simplici, *fide Nees ab Esenb. in Linnæa*, v. p. 641.—R. Kunthii, *Steud. Synops.* ii. p. 251. n. 26.

Hab. C. B. S. Ex. sp. s. ♂. *Dr. Maton in herb. Mus. Brit.*!; *Eck. et Zeyh.* 54. 7. (April.–Decemb.!) ♀. Table Mountain, *Eck. Un. It.* n. 845!; Tulbagh, 56. 5!; *Zeyher*, 4342!; *Sieber, Fl. Cap.* 115! ♂ et ♀. *Drège*, n. 69!

Nees himself has assigned the name *R. dichotomus* to several very different plants in Dr. Sonder's herbarium; hence I have preferred to keep Rottboell's species intact, being the more inclined to do so from the excellent figure he has left us in the work referred to. Steudel's *R. Kunthii* is in no way distinguishable from *R. triflorus*, Rottb. Kunth does not appear to have seen male plants of this species—the only ones, however, described by Rottboell.

R. WALLICHII, sp. n. Rhizomate repenti, squamis coriaceis castaneis obsito; culmis erectis (bipedalibus), infra medium dichotome ramosis, ramisque ascendentibus, strictis, compressiusculis, viridescentibus, minutissime impresso-punctulatis; vaginis oblongis, obtusis, coriaceis, ferrugineis, sub apice obtuso vix membranaceo subulato-mucronatis, aphyllis; spiculis 6–8, plurifloris, in apice ramulorum per paniculas lineares (bipollicares) distiche dispositis, singulis erectis vel erecto-patentibus, cylindraceo-lanceolatis, spatha bracteiformi suffultis (3–4 lin. long., vix 1 lin. lat.); bracteis arcte imbricatis, oblongis, obtusis, coriaceis, nervoso-striatis, sub apice obtuso membranaceo mucronato-subulatis, flores lanceolatos superantibus; glumis externis rigidiusculis, lanceolatis, acutatis, lateralibus conduplicatis, ad carinas ferrugineo villosis; glumis internis 3, dimidio minoribus, ovato-lanceolatis,

membranaceis, maculis ferrugineis notatis; ovario subgloboso, compressiusculo, biloculari, stylo brevi tereti superato; stigmatibus duobus, linearibus, curvatis, exsertis; capsula ——.

Hab. C. B. S. Ex. sp. s. ♀. *Wallich, sine numero in herb. Hook. aliorumque*!

There can be little doubt that this very distinct-looking species is a true *Restio*, although none of the specimens that have come under my observation have had the fruit sufficiently matured to decide the point with certainty.

R. MACER, *Kunth, En.* iii. p. 390. n. 14; *Steudel, Synops.* ii. p. 251. n. 20.—R. limbatus, *Nees, MS. in herb. Sonder.*

Hab. C. B. S. Ex. sp. s. ♂. *Drège*, 2487!; *Eck. et Zeyh.* 1. 11, pro parte! ♀. *Eck.* 84 partim!

Plantæ femineæ cl. Kunthio incognitæ characteres adjicio. *Culmus vaginæ*que ut in mare. *Spiculæ* in apice ramorum 3–5, erecto-patentes, in paniculam simplicem dispositæ, singulæ cylindraceo-lanceolatæ, unguiculares, 1 lin. lat., plurifloræ. *Bracteæ* arcte imbricatæ, oblongæ, coriaceæ, fuscæ, sub apice obtuso profunde hyalino membranaceo subulato-mucronatæ, infima vacua spathacea, spicula vix dimidio brevior; ceteræ fertiles, flores oblongo-lanceolatos stipitatos paulo superantes. *Glumæ externæ* lanceolatæ, laterales conduplicatæ, ad carinas ferrugineo villosæ. *Glumæ internæ* minores, conformes, lateralium marginibus anticis parum involutis. *Ovarium* rotundatum, compressum, biloculare, stylo tereti longiusculo apice bifido exserto superatum. *Capsula* compressa, ovata, bilocularis, lateraliter dehiscens, styli vestigiis coronata, glumis persistentibus obtecta.

In Dr. Sonder's herbarium the male plant of this species is labelled *R. microstachyus β. humilis* by Nees. It differs, however, greatly from other specimens bearing this name, and which I have elsewhere referred to *R. Gaudichaudianus*, Kunth. The female plant in the above-named herbarium is labelled by the same distinguished botanist as *R. limbatus*, N. ab E. MS.; but as there can be little or no doubt that it is the female plant of Kunth's *R. macer*, I have retained the published name of the latter author.

R. SIEBERI, *Kunth, En.* iii. p. 387. n. 9; *Steud. Synops.* p. 250. n. 15.

Hab. C. B. S. Ex. sp. s. ♂. *Masson*!; *Sieber*, 228! sub nom. *R. triflori.* ♀. *Drège*, 9615!; 47 pro parte!; 81!

Plantæ femineæ characteres adjicio. *Culmus vaginæ*que ut in mare. *Spiculæ fructiferæ* 1-5, late ovatæ, 3–4-floræ, 3 lin. long., 2 lin. lat. *Bracteæ* arcte imbricatæ, late ovatæ, coriaceæ, ferrugineæ, sub apice membranaceo mucronatæ, flores maturos haud æquantes. *Glumæ* omnes rigidiusculæ, oblongo-acutæ, pallide ferrugineæ, laterales *externæ* naviculari-conduplicatæ, carinis (villis delapsis) glabris. *Glumæ*

internæ parum breviores. *Capsula* oblique ovata, unilocularis, coriacea, ferruginea, ad latus longitudinaliter dehiscens, styli vestigiis superata. *Semen* magnum; testa grisea, tuberculis parvis obsita.

R. Ecklonii, sp. n. Culmis cæspitosis (pedalibus), teretibus, erectis, flexuosis, rigidiusculis, infra medium di- vel trichotome ramosis, ramisque interdum fasciculatim ramulosis, ramulis erectis, arcuatis, stramineis, sulcatis, minutissime tuberculatis; vaginis arctis, tubulosis, coriaceis, ferrugineis, sub apice obtuso membranaceo subulato-mucronatis, mucrone plerumque reflexo: spiculis masculis 6–8, in apice ramulorum spicatim dispositis, singulis erectis, subcompressis, cylindraceo-lanceolatis (3–4 lin. long., vix 1 lin. lat.); bracteis arcte imbricatis, oblongo-obtusis, coriaceis, pallide ferrugineis, sub apice obtuso membranaceo longiuscule mucronatis, flores oblongo-lanceolatos superantibus; glumis externis oblongo-lanceolatis, chartaceis, lateralibus conduplicatis, ad carinas pallide ferrugineo villosis; glumis internis conformibus, parum brevioribus, hyalinis; antheris linearibus, apiculatis, pallidis. Femina latet.

Hab. C. B. S. Ex. sp. s. ♂. *Ecklon*, 85!; *Eck. et Zeyh.* 55. 8!; ? *Drège*, 2497!

The compressed spikelets, obtuse ends of the oblong bracts, and the narrow, pointed, papery glumes afford good points whereby to discriminate this species. Drège's 2497, of which I have only seen a small fragment, seems very like the above, but the spikelets are much larger.

In Dr. Sonder's herbarium the plant appears under the name of *R. dichotomus*, Thunb., and *R. bifidus* var. β, N. ab E.; in the latter case with a doubt, thus expressed by Nees himself, "an propria species?" As it has nothing to do with either of the plants just named, and as it seems distinct, I have dedicated it to its discoverer.

R.? divaricatus, sp. n. Culmo, ut videtur, pedali et ultra, erecto, tereti, supra medium dichotome ramoso, ramisque longiusculis, erecto-patentibus, cinnamomeo-fuscis, albo tuberculatis; vaginis arctis, tubulosis, unguicularibus, fuscis, coriaceis, albo tuberculatis, sub apice obtuso membranaceo haud hyalino mucronato-aristatis; spiculis 6–8, plurifloris, erectis, in apice ramorum approximatis, spicatim dispositis, singulis ovato-lanceolatis (2–3 lin. long., vix 1 lin. lat.); bracteis arcte imbricatis, ovatis, lanceolatis, subcoriaceis, fuscis, maculatis, sub apice membranaceo obtuso longiuscule aristatis, flores ovatos fere duplo superantibus; glumis externis ovato-oblongis, rigidiusculis, lateralibus conduplicatis, ad carinas ferrugineo villosis; glumis internis minoribus, conformibus, hyalinis; antheris oblongis, apiculatis, flavidis. Femina latet.

Hab. C. B. S. Ex. sp. s. ♂. *Drège*, 2490!

Apparently a very distinct species. I have, however, only been enabled to examine imperfect specimens, and do not know the female plant. The small spikelets disposed in linear spikes, the lanceolate aristate bracts surmounting the florets, and the broad glumes supply good means of recognition.

B. *Spiculæ femineæ pauciforæ.*

* *Styli 2 distincti.*

R. LEPTOSTACHYUS, *Kunth, En.* iii. p. 407. n. 40; *Steud. Synops.* ii. p. 254. n. 53.

Hab. C. B. S. Ex. sp. s. *Drège,* 12, ♂ et ♀!

A cl. Kunthio planta mascula solum descripta. In stirpibus femineis adsunt *culmi vaginæ*que ut in mare. *Spiculæ* 2–4 in apice ramulorum parum remotæ, distiche spicatimque dispositæ, singulæ cylindraceo-lanceolatæ, fructiferæ oblongæ, pyramidales, bifloræ, 3–5 lin. long., 2–3 lin. lat. *Bracteæ* quoad formam ut in mare, basi in internodium spiculæ ita decurrentes ut hoc utrinque alatum. *Glumæ* ut in mare. *Ovarium* stipitulatum, subclavatum, biloculare, stylis duobus distinctis, intus stigmatosis, inclusis superatum. *Capsula* oblique elliptica, abortu unilocularis, lateraliter dehiscens, glumis persistentibus internis dimidio brevior.

R. DEPAUPERATUS, *Kunth, En.* iii. p. 405. n. 37; *Steud. Synops.* ii. p. 253. n. 50.

Hab. C. B. S. Ex. sp. s. ♂ et ♀. *Drège,* 2021 ex parte! ♀. *Drège,* n. 10!

** *Styli 2 connati.*

R. CAPILLARIS, *Kunth, En.* iii. p. 405. n. 36; *Steud. Synops.* ii. p. 253. n. 49.

Hab. C. B. S. Ex. sp. s. ♂. *Drège,* 9! ♂ et ♀. *Drège,* n. 339!

R. GAUDICHAUDIANUS, *Kunth, En.* iii. p. 387. n. 10; *Steud. Synops.* ii. p. 250. n. 16.

Hab. C. B. S. Ex. sp. s. ♂. *Eck. et Zeyh.* 1. 11!; 1. 12! in herb. Sonder. sub nom. cl. Neesio dato *R. microstachyi.* *Eck.* 81!; *Pappe,* 78!; *Drège,* 52!, 1619! ♀. *Drège,* 58!

Plantæ femineæ cl. Kunthio indescriptæ characteres adjicio. *Culmus, rami vaginæ*que ut in mare. *Spiculæ* in apice culmi plerumque binæ, 1–2-floræ, erectæ, sessiles vel breviter pedicellatæ, singulæ ovato-oblongæ, acutæ, fructiferæ subclavatæ, 1–2 lin. long., $\frac{1}{2}$–1 lin. lat. *Bracteæ* arcte imbricatæ, late ovatæ, acutæ, coriaceæ, castaneæ, sub apice breviter mucronatæ, infimæ vacuæ, fertiles flores subæquantes. *Flos* maturus plerumque solitarius, oblongus, pedicellatus. *Glumæ externæ* oblongo-acutæ, rigidæ, subferrugineæ, convexæ, laterales duæ conduplicatæ, villoso carinatæ. *Glumæ internæ* vix breviores, conformes, rigidiusculæ, ferrugineæ. *Ovarium* rotundatum, compres-

sum, uniloculare, stylo crasso tereti apice bifido superatum. *Capsula* oblique ovata, abortu uniloculari, coriacea, ferruginea, ad marginem dehiscens, styli vestigiis coronata, glumisque persistentibus obtecta. *Semen* magnum, ovato-oblongum; testa cinerea, micans, impresso-punctulata, maculis purpureis obsita.

The male plants vary considerably in habit and stature; the spikelets on the same specimen frequently differ considerably in size, and to a less degree in form; the shape of the bracts, glumes, &c., remains constant; the smaller sheaths are frequently close, but the larger ones always lax. In the female plant the spikelets have generally but one perfect flower, and are frequently the subjects of lateral leafy prolification.

R. Eleocharis, *N. ab E. MS.* Culmis sesquipedalibus, erectis, teretibus (crassitie pennæ corvinæ), basi spatio 4-pollicari vaginis spadiceis nitidis approximatis vestitis, medio dichotome ramosis, ramis elongatis, erectis, filiformibus, virgatis, prope basin ramulosis, aphyllis; vaginis arctis, ellipticis, coriaceis, striatis, marginibus parum membranaceis, sub apice membranaceo mucronulatis; spiculis masculis in apice ramulorum solitariis, ellipticis, acutis, erectis, plurifloris (2–4 lin. long., ½ lin. lat.); bracteis arcte imbricatis, oblongis, coriaceis, ferrugineis, sub apice membranaceo mucronatis, flores ovato-lanceolatos breviter stipitatos paulo superantibus; perianthii segmentis externis rigidis, oblongis, lateralibus conduplicatis, ad carinas ferrugineo villosis, segmentis internis paulo brevioribus, oblongis, æqualibus, subhyalinis, dôrso superne ferrugineo maculatis; filamentis ligulæformibus, albidis; antheris linearibus, dorso ferrugineis, apiculatis, demum exsertis. Femineæ culmo habitu parum robustiore, spiculis in apice ramulorum solitariis, bifloris, ovatis, erectis, pluritloribus (1–2 lin. long., vix 1 lin. lat.); bracteis ut in mare; glumis externis rigidiusculis, ovato-lanceolatis, superne parum ferrugineis, lateralibus conduplicatis, ad carinas paulum ferrugineo villosis; glumis internis 3 conformibus, vix brevioribus, tenuioribus, ad margines superne parum involutis; ovario oblongo, compresso, biloculari, ferrugineo, stylo brevi tereti apice bifido coronato. Fructum non vidi.

R. Eleocharis, *N. ab E. in herb. Sonder. absque descriptione.*

Hab. C. B. S. Ex. sp. s. ♂. In planitie Capensi, *Ecklon,* 1 et 560!; *Drège,* 2489! ♀. Zeekoe Valley, 78! 894! (Maii).

R. monanthos, sp. n. Culmis erectis, teretibus, sesquipedalibus (crassitie pennæ corvinæ), parce dichotome ramosis, ramisque ascendentibus, stramineis, impresso-punctulatis, aphyllis; vaginis nisi ad ramificationes arctis, ellipticis, coriaceis, striatis, ferrugineis, sub apice obtuso ferrugineo subulato-mucronatis: spiculis femineis 6–8, in apice ramulorum parum approximatis, spicatim dispositis, singulis subglobosis (magnitudine nuclei cerasi), unifloris; bracteis arcte imbricatis, ovatis,

coriaceis, fuscis, sub apice parum membranaceo acutiusculo subulato-mucronatis: flore femineo solitario (an semper?) bractea stipante vix breviore; glumis externis oblongis, rigidis, ferrugineis, lateralibus naviculari-conduplicatis, ad carinas ferrugineo villosis; glumis internis parum minoribus, late ovatis, obtusiusculis, membranaceis, ferrugineis, lateralium marginibus superne parum involutis; ovario ovato-oblongo, compresso, biloculari, ferrugineo, stylo tereti bifido superato; capsula biloculari (an semper?), ad margines dehiscente, ultra glumas marcescentes producta; seminibus ——.

Hab. C. B. S. Ex. sp. s. *Drège*, 2486, ♀!

R. ROTTBOELLOIDES, *Kunth, En.* iii. p. 394; *Steudel, Synops.* ii. p. 252. n. 32.

Hab. C. B. S. Ex. sp. s. ♂ et ♀. *Drège*, 2494!

The female flowers in this species are destitute of a perianth, the ovary being subtended by a sheathing bract.

R. GRAMINIFOLIUS, *Kunth, En.* iii. p. 407. n. 49; *Steudel, l. c.* 254. n. 52.
Hab. C. B. S. Ex. sp. s. ♂. *Drège*, 2021!

This species is noteworthy for its well-marked foliage, its pedicellate spreading spikelets, and the cellular cushion-like pads placed in the forks of the pedicels.

R. LUDWIGII, *Steudel.* CHAR. EMEND.—Radicibus simplicibus, flexuosis, lignosis, horizontaliter patentibus; culmis pluribus, cæspitosis, erectis, teretibus, spithamæis et ultra, crassitie pennæ passerinæ, basi squamis approximatis castaneis ovatis coriaceis striatis obtectis, versus medium di- vel trichotome ramosis, ramisque filiformibus, erecto-patentibus, flexuosis, tuberculis albis obsitis, aphyllis; vaginis nisi ad ramificationes arctis, coriaceis, ellipticis, sub apice obtusiusculo membranaceo breviter subulato-mucronatis: spiculis masculis solitariis vel binis, in apice ramulorum erectis, ovatis, 1–2-floris (singulis 1 lin. long., vix 1 lin. lat.), spatha aperta vaginæformi suffultis; bracteis laxe imbricatis, oblongis, obtusis, coriaceis, tuberculatis, sub apice parum membranaceo valide subulato-mucronatis, flores lanceolatos vix superantibus; glumis externis oblongis, obtusis, submembranaceis, lateralibus conduplicatis, ad carinas subvillosis; internis conformibus, vix brevioribus, hyalino-membranaceis; filamentis albidis, complanatis; antheris lineari-oblongis, apiculatis, flavidis, exsertis: spiculis femineis 1–2, in apice ramulorum erectis, oblongis, demum pyriformibus, clavatis nutantibusque; bracteis laxe imbricatis (quoad formam ut in mare), floribus solitariis vel binis; glumis externis oblongo-lanceolatis, membranaceis, lateralibus conduplicatis, ad carinas villosulis; glumis internis 3, brevioribus, obtusis, hyalinis, marginibus superne stylum obvolventibus; ovario rotundato, compresso, biloculari, ferrugineo; stylo longo, tereti, ad basin dilatato, ibique flavo, superne in ramos stigmatosos duos revolutos exsertos diviso; capsula oblique

ovata, abortu uniloculari, styli vestigiis notata, glumas persistentes superante.

R. Ludwigii, *Steud. Syn.* ii. p. 254.—R. nutans, *Steud.* (nec *Thunb.*) *Flora*, 1829, p. 134.

Hab. C. B. S. Ex. sp. s. ♂ et ♀. Hottentotshollandberg, *Eck. et Zeyh.* 5, 6, 11!; 135! ♀. *Ludwig in herb. Fielding.*!; *Eck.* 83! 85! (fl. Oct., Nov.)

R. CINCINNATUS, sp. n. Culmo pedali et ultra, erecto, tereti (crassitie pennæ gallinaceæ), basi squamis laceratis approximatis obtecto, versus medium dichotome subfasciculatimve ramoso, ramis elongatis, erecto-patentibus, curvatis, apice subcincinnatis vel strictis, aphyllis; vaginis arctis, oblongis, coriaceis, ferrugineis, striatis, albo tuberculatis, sub apice obtuso membranaceo demum bilobato laceratove mucronato-subulatis: spiculis masculis cylindraceo-lanceolatis (2–3 lin. long., 1 lin. lat.), in apice ramulorum solitariis vel binis, plurifloris; bracteis arcte imbricatis, ovatis, acutis, coriaceis, sub apice membranaceo breviter mucronatis, flores oblongos superantibus; glumis externis oblongis, rigidiusculis, lateralibus conduplicatis, ad carinas ferrugineo villosis; glumis internis minoribus, conformibus, tenuioribus; staminibus 3, filamentis complanatis, latiusculis; antheris oblongis, flavidis, apiculatis: spiculis femineis in apice ramulorum solitariis vel binis, oblongo-lanceolatis, strictis vel leviter arcuatis, erectis (fructiferis subclavatis, nutantibus), unifloribus (1–2 lin. long., $\frac{1}{2}$ lin. lat.); bracteis arcte imbricatis, ovato-acutis, coriaceis, sub apice membranaceo subulatis; flore unico bractea stipante vix breviore, ovato, nec compresso; glumis externis oblongis, obtusis, lateralibus conduplicatis, ad carinas ferrugineo villosis, intermedia superne ad margines parum involuta; glumis internis 3 conformibus, stylum obvolventibus; ovario rotundato, biloculari, basi castaneo, superne flavo, stylo brevi tereti apice bifido superato; capsula oblique ovata, subcompressa, abortu 1-loculari, ad marginem rima longitudinali dehiscente, styli vestigiis coronata, glumis marcescentibus vix breviore.

Hab. C. B. S. Ex. sp. s. ♂ et ♀. *Eck. et Zeyh.* 75. 5!

This plant was considered by Nees von Esenbeck to be referable to *R. Ludwigii*, Steudel, and, in accordance with that opinion, is so named by Nees himself in Dr. Sonder's herbarium. A comparison of the plant, however, with an authentic specimen of *R. Ludwigii*, Steud., in the Fielding herbarium, shows that the two plants, though very closely allied, yet belong to different species, or at least must be considered to do so till further evidence may supply intermediate links between the two. The present species differs from *R. Ludwigii*, Steud., in the larger size of all its parts, in the many-flowered male spikelets, in the more acuminate form of the bracts, in their shorter points and closer disposition. The

glumes, on the other hand, especially in the female plant, are not so sharply pointed as in *R. Ludwigii*, Steud.

R. CURVIRAMIS, *Kunth, En.* iii. p. 395. n. 23; *Steud. Synops.* ii. p. 252. n. 33.

Hab. C. B. S. Ex. sp. s. ♂ et ♀. *Drège*, nn. 54!, 57!, 70!, 1626!, 2498!; *Ecklon et Zeyher*, 1, 11, pro parte. In herb. Sonder. sub nom. cl. Neesio dato *R. microstachyi β. humilis.*

This species seems to be variable in the size cf the culms, spikelets, &c., and to a smaller extent in the shape of the bracts and glumes; but as on the same specimen instances of these differences in form are met with, it is obvious that they do not warrant the formation of more than one species.

R. TENUISSIMUS, *Kunth, En.* iii. p. 394; *Steudel, Synops.* ii. p. 252. n. 31.

Hab. C. B. S. Ex. sp. s. ♂. *Drège*, 1625!; *Dr. Thom in herb. Hook.* 1027! ♂ et ♀. *Drège*, 1970!

This species is remarkable for the reduction in the number of its parts. In both the male and female plants there is but a single flower enveloped by two bracts; there are four glumes only, the two stamens in the male plant being placed opposite to the two inner glumes.

R. LEPTOCLADOS, sp. n. Culmo erecto, tereti, bipedali, basi spatio tripollicari vaginis coriaceis destructis nigrescentibus obsito, superne remote vaginato, olivaceo, impresso-punctulato, versus medium ad vaginas verticillatim ramoso, ramisque filiformibus, elongatis, erecto-patentibus, tuberculis albidis præditis; vaginis culmeis arctis, ellipticis, coriaceis, destructis, rameis ellipticis, sub apice membranaceo longe acuminatis; spiculis in apice ramulorum solitariis, ovatis, acutis (1–1½ lin. long., ½ lin. lat.), fructiferis cuneatis unifloribus; bracteis arcte imbricatis, ovato-oblongis, coriaceis, sub apice membranaceo subulato-mucronatis; flore (ut videtur) solitario, bractea stipante vix breviore; glumis externis lineari-oblongis, medio dorso villoso carinatis, lateralibus conduplicatis; glumis internis tribus vix brevioribus, conformibus, ad margines superne parum involutis pallideque ferrugineis; ovario oblongo, compresso, biloculari, stylo brevi tereti apice bifido superato; capsula oblique ovata, abortu uniloculari, rima longitudinali dehiscente. Masc. ignot.

Hab. C. B. S. Ex. sp. s. ♀. *Drège*, 3!

This species has much of the habit of some of the forms of *R. subverticillatus*, but is readily distinguished from it by the much more oblong form of the bracts, glumes, the presence of only a solitary floret in each spikelet, &c.

SECT. II. *Stigmata 3 subsessilia, distincta, villoso-plumosa. Staminodia ligulæformia vel rarissime nulla. Pistilli rudimentum (in flor. masc.) trigonum.*

* *Culmi plerumque teretes.*

R. STROBILIFER, *Kunth, En.* iii. p. 389. n. 25; *Steud. Synops.* ii. p. 252. n. 38.

Hab. C. B. S. Ex. sp. s. ♂ et ♀. *Drège*, 2474! ♂. *Wallich in herb. Hook.*! False Bay, *Robertson in herb. Mus. Brit.*!

R. PACHYSTACHYUS, *Kunth, En.* iii. p. 399. n. 6; *Steudel, Synops.* ii. p. 252. n. 37.

Hab. C. B. S. Ex. sp. s. *Drège*, 43, ♀!

R. FURCATUS, *Nees, MS.* (absque descriptione). Culmo ut videtur erecto, tereti, 2–3-pedali, dichotome ramoso, ramisque olivaceis, tuberculis albis obsitis, superne parum dichotome ramulosis; vaginis arctis, ellipticis, acutis, coriaceis, fuscis, striatis, superne fusco membranaceis, lacerato-destructis, squamam alteram obtusam dorso bicarinatam amplectentibus; spiculis masculis 8–10, in paniculam terminalem parum ramosam approximatis, singulis erectis, ovatis, acutis (3–4 lin. long., 1 lin. lat.); bracteis undique arcte imbricatis, ovatis, coriaceis, nervoso-striatis, ferrugineis, sub apice fusco membranaceo subulato-mucronatis, flores oblongo-ovatos superantibus; glumis externis oblongis, rigidis, lateralibus conduplicatis, ad carinas ferrugineo villosis; glumis internis tribus, parum brevioribus, hyalinis, basi incrassatis; filamentis complanatis; antheris ovatis, apiculatis, dorso ferrugineis; pistilli rudimento minuto, trigono.

R. furcatus, *Nees, MS. in herb. Sonder.*

Hab. C. B. S. Ex. sp. s. ♂. *Eck. et Zeyh.*!

R. QUINQUEFARIUS, *Nees ab Esenb. Linnæa*, v. p. 639 (1830); *Steud. Synops.* ii. p. 253. n. 48.—R. xyridioides, *Kunth, En.* iii. p. 397. n. 24.

Hab. C. B. S. Ex. s. sp. ♂. In planitie Capensi, *Ecklon*, nn. 564!, 564 *b*!, 565!, 566!; *Eck. et Zeyh.* 78. 8! ♀. False Bay, *Robertson*!, *Lind*!; Wynberg (Aug. c. fr. mat.), *Eck.*! et sub n. 91!; Simon's Town, *C. Wright in herb. Coll. Trin. Dubl.* n. 484! ♂ et ♀. *Drège*, 35!; Cape Town, *Harvey*, 372!

This species varies considerably in size and degree of branching, and to a less extent in the form of the spikelets and in their number, but in all essential points there is too close a resemblance to allow of the species being broken up, especially as numerous intermediate links between extreme forms can be found.

R.? PUNCTULATUS, *Nees, MS.* Culmis sesquipedalibus, decumbentibus, teretibus vel subcompressis (crassitie pennæ corvinæ), prope basin dichotome ramosis, ramisque erectis, olivaceis, albo tuberculatis;

vaginis arctis, ellipticis, coriaceis, striatis, superne profunde hyalino-membranaceis, sub apice acuto subulato-mucronatis; spiculis 1–4, in apice ramorum parum remotis spicatimque dispositis, singulis oblongis, acutis, erectis, plurifloris (6–7 lin. long., 1 lin. lat.), spatha aperta vaginæformi præditis; bracteis imprimis arcte, demum laxe imbricatis, lanceolatis, coriaceis, ferrugineis, marginibus superne membranaceis, basi decurrentibus, flores oblongos trigonos arcuatos triplo superantibus; glumis externis æqualibus, rigidiusculis, oblongis, obtusiusculis, lateralibus conduplicatis, carinatis, carina ala membranacea lacerata prædita; glumis internis inter se æqualibus, externis paulo brevioribus, ovato-lanceolatis, subhyalinis, ima basi connatis; staminodiis nullis; ovario cuneato, trigono, subferrugineo, biloculari, stigmatibus tribus villoso-plumosis coronato; fructu ——.

R. punctulatus, *Nees, MS. absque descrip. in herb. Sonder.*

Hab. C. B. S. Ex. sp. s. ♀. Pampoes Kraal, *Zeyher*, 1737!

The specimens hitherto examined have been too imperfect to allow of the exact structure of the ovary and fruit being satisfactorily made out; hence Nees's indication is here provisionally adopted, not without a strong suspicion that the plant will ultimately be placed in the genus *Calopsis.*

R. distichus, *Rottb. Progr.* p. 11; *Descr. et Ic. Gram.* p. 6. n. 6, t. 2. f. 5; *Willd. Sp. Pl.* iv. 2. p. 275; *Spreng. Syst. Veg.* i. p. 185. n. 32; *Nees ab Esenb. Linnæa,* v. p. 637; *Kunth, En.* iii. p. 409. n. 45; *Steudel, Synops.* ii. p. 254.

Femina latet.

Hab. C. B. S. Ex. sp. s. ♂. Tulbagh (Nov.), *Zeyher* (n. 35?)!; Witsenberg (Dec.), *Zeyher,* 1737!; *Eck. et Zeyh.* 1. 12!, 77. 9! In monte Tabulari, *Ecklon, sine numero*!

Rottboell's description and figure amply suffice for the discrimination of this species, of which Nees also has (*l. c.*) given a good account. The number of spikelets, however, is variable, even on the same specimen. One of the outer glumes is frequently larger than the rest; but this is not constant, and the presence of ferruginous hairs on the outer glumes is equally variable. The confluence of the inner glumes at the base is a noteworthy characteristic in this species. Sprengel, without due reason apparently, refers Thunberg's *R. cuspidatus* to this species. In Dr. Sonder's herbarium one of the specimens received from Zeyher is named by Nees *R. punctulatus* var. *gracilis*, but it differs considerably from other plants so named by the same botanist.

R. triticeus, *Rottb. Progr.* p. 11; *Descr. et Ic.* p. 7, t. 3. f. 1; *Thunb. Diss.* p. 17. n. 18; *Fl. Cap.* i. p. 87. n. 22; *Willd. Sp. Pl.* iv. 2. p. 726. n. 22; *Spreng. Syst. Veg.* i. p. 185. n. 29; *Nees ab Esenb. Linnæa,*

v. p. 640 (pro parte).—R. triticeus β. gracilis, *Nees, in herb. Sonder.* —Calopsis triticea, *Kunth, En.* iii. p. 424; *Steudel, Synops.* ii. p. 258. n. 3.—R. glumaceus, *Klotsch, in herb.*

Hab. C. B. S. Ex. sp. s. ♂ et ♀. False Bay, *Robertson*!; *Alström*!; *Sieber, Fl. Mixta,* 11, ♂!; *Fl. Cap.* 112, ♀!; *Bergius,* ♀!; *Eck. Un. It.* 844, ♂!; *Eck. et Zeyh.* nn. 4. 7, 105. 3, ♂ et ♀!; *Zeyher,* ♂ et ♀, 1742!; *Drège,* 9451, 85, ♂!; *Wright in herb. Coll. S. Trin. Dubl.* n. 495, ♀! (fl. April.); *Dr. Thom,* 1026, ♂!

This species is well described and figured by Rottboell, with the exception of the pistil, which he speaks of and represents as triangular, thus inducing Kunth to place it under *Calopsis*. It is of course possible that what I have here considered to be the female plants of this species are different from those intended by Rottboell. All I can say is that they correspond in all particulars with the male plants, and the structure of their ovaries and capsules shows them to be indubitably members of this genus. The transverse attachment of the spikelets, whose backs are thus parallel to the rachis as in *Triticum*, not edgewise as in *Lolium*, the oblong form of the bracts, which exceed the florets considerably in size, and the pinkish tinge of the inner glumes suffice to distinguish this species. The seeds are large, and studded with large pearl-like tubercles. Some of the specimens have simple fertile culms twice the length of the sterile ones, which latter are erect, dichotomously branched, with very numerous erect, rather rigid branchlets; the sheaths have a leafy tip and are studded with white tubercles. Specimens such as these are noted by Nees as *R. triticeus* var. *β. gracilis.*

R. MULTIFLORUS, *Spreng. Syst. Veg.* i. p. 187. n. 52; *Nees ab Esenb. Linnæa,* v. p. 646; *Kunth, En.* iii. p. 412. n. 31; *Steud. Synops.* ii. p. 254. n. 59.—R. triticeus β. foliosus, *N. ab E. Linnæa,* v. p. 640.—R. triticeus destructus, *N. ab E. in herb. Sonder.*

Hab. C. B. S. Ex. sp. s. ♂ et ♀. In monte Diaboli (Dec.), *Eck. et Zeyh.*!; Table Mt., *Eck.*!; Lion's Mt., *Mundt,* n. 91, ♀!; *Drège,* n. 90, ♀!

This species differs from *R. triticeus* in the form of the spikelets, in their being placed edgewise to the rachis, as well as in the more pointed form of the bracts.

R.? PANNOSUS, sp. n. Culmo erecto, tereti, 2–3-pedali (crassitie pennæ gallinaceæ), infra medium dichotome ramoso, ramisque ascendentibus, elongatis, virgatis, simplicibus, aphyllis, olivaceis, albo tuberculatis; vaginis arctis, ellipticis, longissime acuminatis, coriaceis, fuscis, marginibus superne profunde hyalino-membranaceis, dilaceratis; spiculis 7–12, in paniculas elongatas simplices terminales dispositis, singulis

erectis vel leviter arcuatis, cylindraceo-oblongis, plurifloris, spatha aperta vaginæformi suffultis (3–4 lin. long., 1 lin. lat.); bracteis arcte imbricatis, oblongis, coriaceis, ferrugineis, sub apice parum membranaceis, breviter mucronatis, flores oblongos subtrigonos breviter stipitatos parum superantibus; glumis externis oblongis, rigidiusculis, subfuscis, lateralibus conduplicatis, ad carinas parce villosis; glumis internis tribus, vix brevioribus, hyalinis, ima basi connatis, inæqualibus, postica latiore; antheris linearibus, apiculatis, ferrugineis; pistilli rudimento minuto, tristylo; ovario cuneato, subcompresso, purpureo, margine viridescente, stigmatibus villoso-plumosis coronato, ad basin staminodiis tribus ligulæformibus circumdato; fructu ——.

Hab. C. B. S. Ex. sp. s. ♂ et ♀. False Bay, *Robertson*!; *Eck. et Zeyh.* 78. 7! Cape Flats, *Ecklon*!; *Zeyher*, 1742, ♂!

A species apparently nearly allied to *R. triticeus*, Rottb., but differing from it in the more branched inflorescence, in the smaller spikelets, in the presence of a spathe, in the different form and proportions of bracts, glumes, &c. The membranous edges of the sheaths and spathes give the plant a very ragged aspect—whence the name.

** *Culmi plerumque compressi v. angulati.*

R. TETRAGONUS, *Thunb. Prod.* p. 15; *Diss.* p. 17. n. 17; *Fl. Cap.* i. p. 87. n. 20; *Willd. Sp. Pl.* iv. 2. p. 725. n. 21; *Nees ab Esenb. Linnæa*, v. p. 642; *Kunth, En.* iii. p. 400; *Steudel, Synops.* ii. p. 253.

Var. β. EXALTATUS, *Nees, l. c.* Culmo alto folioso, panicula virgata, spiculis sessilibus pedunculatisque.

Hab. C. B. S. Ex. sp. s. ♂. *Masson*!; False Bay, *Robertson*!; *Eck.* 85! ♀. *Sieber, Fl. Cap.* 118!; ad pedem montis Diaboli altit. ii., inter frutices, *Eck.* (August); *R. C. Alexander*!—β. ♂, ad cataractas montis Diaboli (Junio), *Eck.*!; *Drège*, ♂, 364!; *Milne in herb. Hook.* 435!

A distinct and handsome species, varying in luxuriance according to the situation in which it grows. The female plant distributed under *Drège*, 364, belongs to a hitherto undescribed species, *R. bifurcus*, Nees, MS.

R. EGREGIUS, *Hochstetter, Flora*, (*B. Z.*) 1845, p. 337, *adnot.*; *Steudel, Synops.* ii. p. 253.

Var. β. NUTANS, *Mast. MS.* Culmis spiculisque minoribus, spiculis (masculis) nutantibus.

Hab. C. B. S. Ex. sp. s. ♂ et ♀. *Zeyher*. ♂. Hottentotshollandberg, *Ecklon*!; *Dr. Thom in herb. Hook.* 632!, 906!—β. ♂ et ♀. *Zeyher*!; *Admiral Grey in herb. Hook.*!; Table Bay, *Robertson*!; False Bay, *Robertson*!

It is remarkable that so handsome-looking a species should

have been overlooked so long. The female plant has a much more simple inflorescence than the male, and much larger spikelets.

R. BIGEMINUS, *Nees, MS.* Ramis primariis compressis (crassitie pennæ corvinæ), parum dichotome ramulosis, ramulisque ascendentibus, elongatis, olivaceis, punctulatis, minutissime albo lepidotis, aphyllis; vaginis arctis, ovatis, coriaceis, sub apice obtuso membranaceo retuso herbaceo-cuspidatis, ad ramificationes squamam alteram oblongam bicarinatam amplectentibus; spiculis (femineis) in apice ramulorum 1–5 approximatis, in racemum erectum terminalem dispositis, singulis erectis, plurifloris, ovato-oblongis v. ellipticis (7–8 lin. long., 1–2 lin. lat.), sessilibus vel breviter pedicellatis, basique spatha aperta vaginæformi brevi præditis; bracteis laxiuscule imbricatis, oblongo-lanceolatis, coriaceis, ferrugineo-griseis, micantibus, prominenter septemnervosis, sub apice tenuiore mucronulatis, infimis vacuis, ceteris flores oblongo-acutos pedicellatos triplo superantibus; glumis externis rigidiusculis, oblongo-lanceolatis, æqualibus, pallide ferrugineis, lateralibus conduplicatis, carinatis, carina glabra; glumis internis conformibus, dimidio brevioribus, vix hyalinis, postica latiore; staminodiis 3, ligulæformibus; ovario rotundato, apice truncato, ferrugineo, biloculari; stigmatibus elongatis, villoso-plumosis; capsula rotundata, bi- vel abortu uniloculari, coriacea, ferruginea, ad margines dehiscente, stigmatum vestigiis coronata; seminibus magnis, oblongis, ferrugineis, testa subcoriacea tuberculis majusculis obsita.

R. bigeminus, *Nees, MS. in herb. Sonder.*—R. (Thamnochorti) micantis feminea, *Nees, MSS., sed vix.*

Hab. C. B. S. Ex. sp. s. ♀. Cape Flats (August), *Eck. et Zeyh.* 1123.

In Dr. Sonder's herbarium are two specimens, evidently of the same species: one has a label attached to it, with the name *R. bigeminus*, mihi (*i. e.* Nees); the other, which is precisely similar, has the name "*R. micans*, N. ab E. in Linnæa, v. p. 649," in the handwriting of that botanist; but as neither specimen accords well with the description of *R. micans* in the 'Linnæa,' I have preferred to adopt the name *R. bigeminus*.

R.? DISPAR, sp. n. Ramis primariis erectis (crassitie pennæ gallinaceæ), subcompressis, dichotome ramulosis, ramulis erectis, curvatis, olivaceis, albo tuberculatis; vaginis semipollicaribus, arctis, ellipticis, acutis, coriaceis, fuscis, marginibus superne hyalino-membranaceis, destructis; spiculis 4–6, in spicam disticham flexuosam approximatis, singulis oblongis, acutis, erectis (5–6 lin. long.), spatha magna aperta vaginæformi suffultis; bracteis arcte imbricatis, omnibus fertilibus, singulis oblongis, convexis, vix carinatis, rigidis, purpurascentibus, flores oblongos duplo superantibus; glumis externis inæqualibus, oblongis, obtusis, rigidis, lateralibus conduplicatis, villoso-carinatis;

glumis internis inter se æqualibus, externis paulo brevioribus, oblongis, acutis, hyalinis, basi incrassatis; antheris oblongis, apiculatis, purpurascentibus; pistilli rudimento minuto. Femina latet.

Hab. C. B. S. Ex. sp. s. ♂. *Eck. et Zeyh.* 52. 8.

One of the outer lateral glumes in this species exceeds its fellow in size, and partially overlaps it.

R. BIFURCUS, *Nees, MSS.* Culmis erectis, bipedalibus, simplicibus vel parum dichotomeque ramosis, ramisque compressiusculis, olivaceis, squamis orbicularibus albidis obsitis; vaginis arctis, semipollicaribus, tubulosis, coriaceis, striatis, fuscis, sub apice obtuso membranaceo cuspidatis, basi annulo impresso notatis, ad ramificationes nonnunquam squamam alteram oblongam dorso bicarinatam villosam amplectentibus: spiculis masculis pluribus, in paniculam erectam cymosam elongatam magis minusve ramosam dispositis, singulis plurifloris, erectis, ovatis, sessilibus vel breviter pedicellatis (3–5 lin. long., 1–2 lin. lat.), basi spatha vaginæformi suffultis; bracteis arcte imbricatis, oblongis, coriaceis, castaneis, dorso superne impresso-punctulatis, sub apice obtusiusculo cuspidatis, infimis 2–3 vacuis, ceteris fertilibus, flores masculos oblongos stipitulatos vix æquantibus; glumis externis oblongis, obtusis, rigidiusculis, dorso medio villosis, lateralibus naviculari-conduplicatis; glumis internis parum brevioribus, oblongo-lanceolatis, hyalinis, ima basi connatis, nonnunquam incrassatis; filamentis complanatis, albidis, intra discum parvum membranaceum lobatum orientibus; antheris lineari-oblongis, dorso ferrugineis, demum exsertis; pistilli rudimento trigono: spiculis femineis paucioribus, in paniculam minus ramosam dispositis, singulis oblongo-lanceolatis, demum subclavatis, paucifloris (4–5 lin. long., 1–2 lin. lat.); bracteis glumisque ut in mare; staminodiis 3, ligulæformibus, basi disco membranaceo parvo lobato cinctis; ovario trigono, nigro-castaneo, biloculari, stigmatibus longis villoso-plumosis superato; capsula biloculari, glumis persistentibus obtecta.

R. bifurcus, *Nees, MS. in herb. Sonder.*

Hab. C. B. S. Ex. sp. s. Gnadenthal, *Eck. et Zeyh.* ♂ et ♀, n. 39! In planitie Capensi, *Eck.* n. 564*c*, ♂! Cape Flats, *Zeyher*, ♂ et ♀, 1011; *Drège*, nn. 46, 364, 1608, ♀!; *Dr. Thom in herb. Hook.* 49, ♂! Cape Town, *Harvey*, ♂!

Adsunt nonnunquam *culmi steriles* quam fertiles dimidio breviores, supra basin dichotome ramosi, ramique ramulosi, ramulis longiusculis, ascendentibus, compressis, olivaceis, albo lepidotis; *vaginæ* arctæ, coriaceæ, olivaceæ, sub apice obtuso membranaceo, nec hyalino, longissime foliaceo-mucronatæ.

Both male and female spikelets occasionally have a small leaf-bud in the place of a flower (lateral foliar prolification). The small membranous disk which is so constantly found in this spe-

cies between the inner series of glumes and the stamens or the staminodes is of interest, as it may possibly represent an outer series of stamens alternating with those usually present, which are *opposite* to the inner glumes. Should this view of the nature of the disk be correct, the normal symmetry of the flower would be restored.

R.? FESTUCÆFORMIS, *Nees, MS.* Culmis cæspitosis, erectis, subcompressis (sesquipedalibus, diametro pennæ corvinæ), simplicibus vel supra medium parum dichotome ramosis, ramisque ascendentibus, stramineis, impresso-punctulatis; vaginis pollicaribus, arctis, ellipticis, coriaceis, striatis, fuscis, marginibus superne membranaceis, sub apice obtusiusculo longe setaceis; spiculis pluribus, in cymam densam terminalem obovatam aggregatis, singulis erectis, plurifloris, cylindraceo-oblongis (8–10 lin. long., 1 lin. lat.); bracteis laxe imbricatis, lanceolatis, chartaceo-membranaceis, pallide fuscis, dorso nervo medio prominente notatis, infimis vacuis, ceteris flores stipitulatos longe superantibus, basi ita decurrentibus ut spiculæ rachis alata videtur; glumis externis oblongo-obtusis, subcoriaceis, cinereis, pubentibus, lateralibus conduplicatis, vix carinatis; glumis internis planiusculis, vix brevioribus, angustioribus (in flore masculo hyalinis, in flore femineo chartaceis); filamentis capillaribus; antheris oblongis, apiculatis, antice flavis, dorso ferrugineis; ovario parvo, oblongo vel subrotundo, biloculari, stigmatibus tribus villosis superato; capsula ——.

R. festucæformis, *Nees, MS. in herb. Sonder.*—R. ischæmoides, *Nees, MS. (olim).*

Hab. C. B. S. Ex. sp. s. ♂ et ♀. *Eck. et Zeyh.* 56. 5!

In the absence of ripe fruit, there remains a doubt whether this very distinct-looking species belong really to this genus or not. So far as I have been able to ascertain, Nees has nowhere published the species under either of the names affixed to it in his handwriting in Dr. Sonder's herbarium. The female plant almost precisely corresponds with the male, *mutatis mutandis.* In the male plant the flowers are somewhat curved laterally, so that one of the outer lateral glumes becomes thereby much more conduplicate than the other.

R. SUBULATUS, *Mast. MS.* Culmis sterilibus decumbentibus, spithamæis, ramosissimis, ramulis subfasciculatis; vaginis tubulosis, arctis, coriaceis, brunneis, superne membranaceis, sub apice longe subulato-mucronatis: culmis fertilibus sesquipedalibus, simplicibus, compressis, olivaceis, impressis, albo tuberculatis; spiculis masculis femineisque conformibus, 6–8, in spicam linearem terminalem approximatis, singulis ovato-oblongis (3–4 lin. long., 3 lin. lat.); bracteis oblongis, coriaceis, sub apice mucronatis, laxe imbricatis, infimis sterilibus, ceteris flores

superantibus; glumis externis rigidiusculis, oblongo-acutis, lateralibus conduplicatis, villoso carinatis; glumis internis parum brevioribus, latioribus, hyalinis; antheris flavis, dorso castaneis; pistilli rudimento minuto; staminodiis 3; ovario ——; capsula ovata, compressa, biloculari, coriacea, ferruginea.

Hab. C. B. S. Ex. sp. s. ♀. *Eck. et Zeyh.* 51. 7!

R. PURPURASCENS, *Nees, MS.* (*absque descriptione*). Culmo erecto, valido, compressiusculo, bi–tripedali (crassitie pennæ anserinæ), versus medium dichotome ramoso, ramis longiusculis, erecto-patentibus; vaginis, nisi ad ramificationes, arctis, ellipticis, obtusis, fuscis, coriaceis, purpureo maculatis, marginibus superne membranaceis, sub apice obtuso foliaceo-mucronatis; spiculis 2–5, in apice ramorum spicatim dispositis, approximatis vel parum remotis, sessilibus vel pedicellatis, singulis oblongis, obtusis, erectis, pollicaribus (2–3 lin. lat.), basi spatha aperta vaginæformi præditis; bracteis laxe imbricatis, infimis vacuis, ceteris fertilibus, oblongis, acutis, coriaceis, ad margines membranaceis, flores 3–4plo superantibus; glumis externis rigidiusculis, oblongo-lanceolatis, lateralibus naviculari-conduplicatis, villoso-carinatis, intermedia basi incrassata, lateralibus vix longiore; glumis internis brevioribus, subhyalinis, conformibus, in plant. masc. imo basi connatis; antheris lineari-oblongis, apicatis, dorso ferrugineis, antice flavidis; pistilli rudimento trigono; ovario subtrigono, castaneo, biloculari, stigmatibus tribus linearibus villosis elongatis superato; capsula biloculari, ad margines dehiscente.

Variat culmo spiculisque minoribus.

R. purpurascens, *Nees, MS. in herb. Sonder.* Femina tantum.

Hab. C. B. S. Ex. sp. s. ♂. *Dr. Lind in herb. Mus. Brit.*! ♀. Hottentotshollandberg (Maio), *Eck. et Zeyh.* 59. 5!

This handsome species seems closely allied to *R. compressus*, Rottb., especially to the larger variety of that plant; but the culms and spikelets are not nearly so much compressed. In the present plant the whole surface is covered with purplish spots.

R. IMPOLITUS, *Kunth, En.* iii. p. 404; *Steud. Synops.* ii. p. 253.

Hab. C. B. S. Ex. sp. s. ♂. *Drège*, nn. 66, 67! Femina latet.

R. SPINULOSUS, *Kunth, En.* iii. p. 402. n. 32; *Steud. Synops.* ii. p. 253. n. 43.

Hab. C. B. S. Ex. sp. s. ♂. *Drège*, 37!

R. COMPRESSUS, *Rottb. Descr. et Ic.* p. 6, t. 2. f. 2; *Willd. Sp. Pl.* iv. 2. p. 725. n. 19; *Spreng. Syst. Veg.* i. p. 185 (excl. syn. *R. cuspidati* Thunb. cui culmus teres); *Kunth, En.* iii. p. 403. n. 33; *Nees ab Esenb. Linnæa*, v. p. 642; *Steud. Synops.* ii. p. 253. n. 44.

Var. *β.* MAJOR, culmo robustiore, spiculis majoribus.

Hab. C. B. S. Ex. sp. s. ♂ et ♀. *Eck. et Zeyh.* 56. 5!; *Drège*, 33!—Var. *β.* Locis humidis in planitie Tabulari (April). ♂. *Eck.* n. 842!;

Un. It. 849!; *Sieber,* 224!; *Eck. et Zeyh.* 51. 8! Babyloonske-toorne (August), *Zeyh.* 4350!; *Drège,* 48!

R. FASTIGIATUS, *Nees, MS. in herb. Sonder.*—R. callistachyus, *Kunth, En.* iii. p. 400. n. 29; *Steud. Synops.* ii. p. 253. n. 40 (quoad plantam femineam).—R. polystachyus, *Kunth, En.* iii. p. 402. n. 31; *Steud. Synops.* ii. p. 253. n. 42 (quoad plantam masculam).—R. elongatus, *Thunb.* (♀) *teste Hochstetter, sed vix.*—R. digynus ♀, *Link, MS. in herb. Sonder.*—R. dubius ♂, *Klotsch in herb.*

Hab. C. B. S. Ex. sp. s. ♀. *Zeyher,* nn. 539, 4341 (Febr.)!; Winterhoeck, *Ecklon*!; Uitenhage, *Krauss* (April), *teste Hochstetter*; *Krebs teste Link*; *Drège,* n. 30! ♂. *Ecklon*!, *Zeyher*!, *Mundt*!; *Drège,* n. 32!

I have ventured in this case to depart from the usual rule of adopting a manuscript rather than a published name, for the following reasons:—Nees, as I believe correctly, recognized the two forms as male and female respectively of the same species, and applied a very appropriate name, and one equally applicable to either sex. So far as I have been able to ascertain, Nees did not in any way publish the name. Later, when Kunth examined Drège's specimens for his 'Enumeratio,' he considered the male and female plants to constitute two distinct species, and named them accordingly, but neither of his names is so appropriate to either plant as Nees's.

*** *Culmi filiformes.*

R. VAGINATUS, *Thunb. Prod.* p. 15; *Diss.* p. 10. n. 2; *Fl. Cap.* i. p. 83. n. 2; *Willd. Sp. Pl.* iv. 2. p. 719. n. 4; *Spreng. Syst. Veg.* i. p. 184. n. 3; *Kunth, Enum.* iii. p. 408. n. 42; *Hochstetter, Flora,* (*B. Z.*) 1845, p. 337.—R. pseudoleptocarpus, *Kunth, En.* iii. p. 399; *Steud. Synops.* ii. p. 252. n. 39.

Hab. C. B. S. Ex. sp. s. ♂ et ♀. *Sieber, Herb. Cap.* 221; *Flora Mixta,* 22! In summitate montis Tabularis (Jan.–April.), *Eck.*! Uitenhage, *Zeyher,* ♀!; *Ludwig,* ♂! Cape Town, *Harvey,* ♂!; *Drège,* 28, ♂! Table Mountain (Maio), *Krauss.*

Hochstetter, I believe correctly, speaks of the above in these words: "*R. pseudoleptocarpus* Kunth. ipsissimus *R. vaginatus* Thunb. esse videtur, quem inter dubias, a se non visas, cl. Kunthius enumerat."

R. DEBILIS, *Nees ab Esenb. Linnæa,* v. p. 640; *Kunth, En.* iii. p. 412. n. 50; *Steud. Synops.* ii. p. 254.—Thamnochortus debilis, *Zeyh. teste Kunth.*

Hab. C. B. S. Ex. sp. s. ♂. *Zeyher,* n. 33 (Martio, Aprili)!

Plantæ cujusdam femineæ, in herb. Sonderiano, a me examinatæ, huic speciei forsan referendæ, notas adjicio:—

Culmus 2–3-pedalis, erectus, teres v. subcompressus, crassitie pennæ corvinæ, versus medium dichotome ramosus, ramique ascendentes, elongati, olivacei, tuberculis albidis parvis obsiti, iterum subfasciculatim ramulosi, ramulis ultimis diffusis, filiformibus, rigidiusculis (aphyllis?). *Vaginæ*, nisi ad ramificationes, arctæ, ellipticæ, striatæ, marginibus superne membranaceis, sub apice obtusiusculo setaceo aristatæ. *Spiculæ* in apice ramulorum solitariæ, ovato-oblongæ, 1–2 lin. long., vix 1 lin. lat., plurifloræ. *Bracteæ* laxe patentes, oblongæ, coriaceæ, ferrugineæ, sub apice membranaceo acute mucronatæ, flores oblongos vix superantes. *Glumæ externæ* 3, æquales, oblongæ, rigidiusculæ, pallide ferrugineæ, laterales duæ conduplicatæ, ad carinas ferrugineo villosæ; *glumæ internæ* 3, externas longitudine æquantes, latitudine autem eas superantes, oblongæ, spathulatæ, chartaceæ, pallide ferrugineæ. *Staminodia* nulla? *Ovarium* ut videtur oblongum, subtrigonum, stigmatibus linearibus villosis tribus superatum.

The specimen examined was too imperfect to allow of the structure of the ovary being satisfactorily determined. Sprengel is stated by Nees (*l. c.*) to have referred this plant to the genus *Thamnochortus*.

R. MISER, *Kunth, En.* iii. p. 392. n. 19; *Steud. Synops.* ii. p. 252.
Hab. C. B. S. Ex. sp. s. ♂ et ♀. *Drège*, 1627!

Kunth has erroneously placed this species in the two-styled section. The female flowers have staminodia and a trigonous two-celled ovary surmounted by three styles.

R. SUBTILIS, *Nees, MS.* Culmis sterilibus erectis, subcompressis, filiformibus (sesquipedalibus), sulcatis, parce dichotome ramosis, ramisque tenuissimis, erectis, longissimis, remote vaginatis, stramineis: culmis fertilibus consimilibus, longioribus, supra medium ramosis; vaginis arctis, tubulosis, unguicularibus, coriaceis, sulcatis, marginibus superne vix membranaceis, sub apice obtusiusculo foliaceo-mucronatis; spiculis remotis, in paniculam laxam cymosam elongatam dispositis, sessilibus v. longiuscule pedicellatis, singulis ovatis, acutis, bifloris (vix 1 lin. longis, $\frac{1}{2}$ lin. lat.); bracteis arcte imbricatis, late ovatis, coriaceis, fuscis, marginibus superne membranaceis, apice vix acuminato-mucronatis; floribus (masculis) ovatis, subcompressis, bracteis stipantibus, vix brevioribus; glumis externis ovato-oblongis, rigidiusculis, pallide fuscis, lateralibus conduplicatis, vix carinatis; glumis internis æqualibus, conformibus, vix brevioribus, hyalinis; antheris linearibus, flavis; pistilli rudimento minuto, trigono: spiculis femineis ut in mare, nisi numero paucioribus magnitudineque parum majoribus; staminodiis ligulæformibus; capsula trigona, triloculari (trisperma?), angulis salientibus dehiscente, superne stylorum vestigiis coronata, purpurea.
R. subtilis, *Nees ab E. in herb. Sonder.*
Hab. C. B. S. Ex. sp. s. ♂ et ♀. *Eck. et Zeyh.* 56. 6.

R. Sonderianus, sp. n. Culmis cæspitosis, spithamæis, filiformibus, erectis, flexuosis, simplicibus, rigidis, flavidis, minutissime punctulatis, basi spatium pollicare vaginis coriaceis castaneis impresso-punctulatis striatis dense obsitis, superne remote vaginatis; vaginis arctis, ellipticis, coriaceis, fuscis, nervoso-striatis, sub apice membranaceo cinereo subulato-mucronatis; spiculis 1–4, in apice culmi approximatis, sessilibus vel breviter pedicellatis, singulis ovato-oblongis, erectis (3–4 lin. long., vix 2 lin. lat.), basi spatha aperta vaginæformi suffultis; bracteis primum arcte demum laxe imbricatis, infimis sterilibus, oblongo-obtusis, coriaceis, nervoso-striatis, mucronato-aristatis, ceteris fertilibus, oblongis, acuminatis, castaneis, flores oblongos arcuatos vix superantibus; glumis externis oblongis, rigidiusculis, lateralibus conduplicatis, ad carinas glabris; glumis internis parum minoribus, conformibus, hyalinis, basi ferrugineis; antheris lineari-oblongis, flavidis, exsertis; pistilli styli rudimento minuto.

Hab. C. B. S. Ex. sp. s. ♂. *Drège,* 82 pro parte!

Kunth cites under *Drège* 82 his *R. pseudoleptocarpus*=*R. vaginatus,* Thunb., from which, however, the present differs considerably in size, in the warting of the culms, and in the form of the spikelets and glumes. It more nearly resembles the following species (*R. pedicellatus,* Mast.), also distributed with *Drège* 82, but is distinguished by the sheaths and especially by the bracts.

R. pedicellatus, sp. n. Culmis pedalibus, cæspitosis, erectis, filiformibus, teretibus, rigidis, simplicibus, flavidis, tuberculis obsitis, basi spatium pollicare vaginis ellipticis coriaceis castaneis striatis impresso-punctulatis sub apice retuso pallidiore subulato-mucronatis (mucrone sæpissime in folium elongatum lineare producto) obtectis; vaginis culmeis remotis, arctis, semipollicaribus, fuscis, striatis, sub apice emarginato membranaceo plerumque foliaceo-mucronatis; spiculis in apice culmi solitariis vel binis, erectis, juvenilibus cylindraceo-lanceolatis, demum oblongis, plurifloris (3–4 lin. long., 1–2 lin. lat.); bracteis primum arcte demum laxe imbricatis, oblongo-acutis, coriaceis, castaneis, sub apice obtuse mucronulatis, flores oblongos pedicellatos superantibus; glumis externis rigidiusculis, oblongo-obtusis, lateralibus conduplicatis, ad carinas glabris; glumis internis parum brevioribus, hyalinis; filamentis linearibus, albidis; antheris linearibus, flavidis, exsertis; pistilli rudimento minuto; staminodiis ligulæformibus; ovario trigono, abortu biloculari, castaneo, angulis salientibus viridescente, stigmatibus tribus coronato; capsula rotundata, biloculari, dehiscente, stigmatum vestigiis superata.

Hab. C. B. S. Ex. sp. s. ♂. *Drège,* 1629!; ♀. nn. 82! (pro parte), 91!

This differs from *R. Sonderianus* especially in the oblong obtuse glumes, which are provided with a very short "mucro;" the

spikelets are also somewhat longer and of a more oblong shape than in the species just mentioned.

R. Harveii, sp. n. Rhizomate repenti, culmos plures teretes ascendentes squamis laceratis approximatis obtectos emittente: ramis sterilibus 2–4-pollicaribus, basi decumbentibus, teretibus, subspongiosis, infra medium dichotome ramulosis, ramisque curvatis, subcompressis, patentibus, sordide olivaceis, tuberculis albis parvis dense obsitis; vaginis arctis, ovatis, acutis, marginibus membranaceis, sub apice obtuso subulato-mucronatis: ramis fertilibus conformibus, duplo longioribus; spiculis in apice ramulorum solitariis, oblongo-cuneatis, bifloris (1 lin. long., vix 1 lin. lat.); bracteis laxe imbricatis, ovatis, acutis, convexis, marginibus superne membranaceis, sub apice acuto subulato-mucronatis, infimis 2 vacuis, ceteris fertilibus flores oblongos vix duplo superantibus; glumis externis æqualibus, oblongis, obtusis, chartaceis, marginibus ciliolatis, lateralibus conduplicatis, ad carinas ciliolatis; glumis internis conformibus, vix brevioribus, dorso medio subcarinatis, ciliolatis; staminodiis 3; ovario oblongo, subcompresso, biloculari, stigmatibus 3 villosis superato; fructu ——.

Hab. C. B. S. Ex. sp. s. ♀. Cape Town, *W. H. Harvey in herb. Coll. S. Trin. Dubl.!*

The comparatively long trailing rhizome of this plant, like that of *Carex arenaria*, gives it a distinct aspect from the other species. Its spongy texture is also remarkable. In the form of its spikelets it much resembles *R. tenuissimus*, Kunth, but the structure of the spikelets and flowers is very different (see Pl. XV. figs. 1–7).

R. perplexus, *Kunth, En.* iii. p. 406. n. 38; *Steudel, Synops.* ii. p. 253. n. 51.—R. dichotomus, *Willd. herb.* (nec *Thunb.*) *teste Kunth.*

Hab. C. B. S. Ex. sp. s. ♂ et ♀. *Drège, 339a!* ♂. *Breutel!*; *Drège,* n. 8!

R. bifidus, *Thunb. Fl. Cap.* i. p. 87; *Nees ab Esenb. Linnæa,* v. p. 636; *Kunth, En.* iii. p. 409; *Steud. Synops.* ii. p. 250.—R. filiformis, *Poir. Enc. M. V.* p. 173?—R. monostachyus, *Steud. in herb.*—Variat spicis 1–4.

β. "Culmo flexuoso mono- vel distachyo, vaginis in mucronem longum trigono-subulatum foliaceum patulum exeuntibus."—*Nees, l. c.*

R. oligostachyus, *Kunth, En.* iii. p. 399. n. 27; *Steud. Synops.* ii. p. 252. n. 38.—R. bifidus, *N. ab E., forma gracilis in herb. Sonder.*

Hab. C. B. S. Ex. sp. s. *Thunberg in herb. Sonder.!*; *Eck. Un. It.* nn. 840, 846, ♂, forma depauperata = R. monostachyus, *Steud.!*; *Eck. et Zeyh.* 56. 5, ♂! Table Mountain, *Ecklon,* 77, ♂ et ♀!; *Breutel,* ♀!; *Zeyher,* 4343, ♂ et ♀!; *Drège,* 197!, 84 ♀, 1628 *b*! Simon's Town, *C. Wright in herb. Coll. S. Trin. Dubl.,* sub nn. 485, 497 ♂! (Aug.)—β. False Bay, *Robertson in herb. Mus. Brit.* ♀! Table Mountain, *Eck. et Zeyh.* ♀, 1. 11!, 1. 12!; *Drège,* nn. 37!, 1624 ♀! Simon's Town, *Wright!*

This species varies considerably in stature, number of spikelets, &c.; moreover the aspect of the immature spikelets is often considerably different from that pertaining to their fully developed condition. The bluntish, white-edged scales are useful guides in the discrimination of this species. The variety β is subject to the same diversities of size, &c., as the species. Kunth has given the name *R. oligostachyus* to a form with elongated flexuose culms and large solitary spikelets. Steudel (in herb. Fielding.) gave the name *R. monostachyus* to a starved form of the species with slender, slightly flexuose culms and small spikelets. Some of the forms much resemble *R. Garnottianus*, but in that species the spikelets are more numerous, and the bracts are more acutely pointed, while their membranous edge is not so well marked, and their mucros are less abrupt than those of *R. bifidus*.

R. Garnottianus, *Kunth, En.* iii. p. 392. n. 18; *Steud. Synops.* ii. p. 251.

Hab. C. B. S. Ex. sp. s. ♂. *Ecklon*!; *Drège*, nn. 59!, 1628 *a*! et 2473! ♀. *Ecklon*!, *Zeyher*!

Plantæ femineæ adhuc indescriptæ characteres adjicio. *Culmus, vaginæ spiculæ*que ut in mare. *Flores* oblongi, sessiles. *Glumæ externæ* rigidiusculæ, oblongo-acutæ, laterales naviculari-conduplicatæ, villoso carinatæ, intermedia antica subconvexa dorso medio nervo ferrugineo notata; *glumæ internæ* conformes, parum minores, hyalinæ. *Staminodia* 3, albida. *Ovarium* trigonum, castaneum, biloculare, stylis 3 villosis superatum. *Capsula* lenticularis, trilocularis, dehiscens, glumis persistentibus obtecta.

In Dr. Sonder's herbarium some specimens of this plant are labelled as *R. dichotomus* by Nees. It is closely allied to *R. bifidus*, and may, indeed, be merely a form of that variable species.

Species mihi non satis notæ, plerumque forsan sub aliis nominibus recensitæ.

R. elongatus, *Thunb. Fl. Cap.* i. 83; *Kunth, En.* iii. p. 408. n. 43.

R. concolor, *Steud. Synops.* ii. p. 251; *Drège*, n. 31.

R. pauciflorus, *Poir. Enc. Méth.* vi. 168; *Kunth, En.* iii. p. 412. n. 49.

R. fruticosus, *Thunb. Diss.* p. 16. n. 14; *Kunth, En.* iii. p. 413. n. 54 (an hujus generis?).

R. glomeratus, *Thunb. Diss.* p. 18. n. 19; *Fl. Cap.* i. 88; *Kunth, En.* iii. p. 414.

R. simplex, *Thunb. Diss.* p. 16. n. 15; *Kunth, En.* iii. p. 414.

R. lucens, *Poir. Enc. Méth.* vi. 169; *Kunth, En.* iii. p. 414.

R. vimineus, *Rottb. Descr. et Ic.* iv. t. 2. f. 1.

Species excludendæ.

R. aristatus, *Thunb.* = Hypodiscus aristatus, *Nees.*
R. alboaristatus, *Nees* = Hypodiscus alboaristatus, *Nees.*
R. synchroolepis, *Steud.* = Hypodiscus synchroolepis.
R. echinatus, *Kunth* = R. squarrosus, *Lam.*
R. simplex, *Thunb.* = Staberohæ sp.
R. fuirenoides, *Kunth* = R. setiger, *Mast.*
R. Lucæanus, *Kunth* = R. Sprengelii, *Mast.*
R. tetrasepalus, *Steud.* = Staberohæ sp.
R. sulcatus, *Kunth* = Lepidanthus Willdenowia, *Nees.*
R. dichotomus, *Linn. Syst. Nat.* ed. 12. p. 735 = Thamnochortus fruticosus, *Berg. Fl. Cap. teste ipso Linnæi MS. in bibliotheca Linnæana.*
R. callistachyus, *Kunth* = R. fastigiatus, *Nees.*
R. polystachyus, *Kunth* = R. fastigiatus, *Nees.*
R. pseudoleptocarpus, *Kunth* = R. vaginatus, *Thunb.*
R. oligostachyus, *Kunth* = R. bifidus, *Thunb.*
R. obtusissimus, *Steud.* = R. digitatus, *Thunb.*
R. xyridioides, *Kunth* = R. quinquefarius, *Nees.*
R. dichotomus, *Rottb.* = Thamnochortus dichotomus, *Brown.*
R. acuminatus, *Thunb.* = Cucullifera dura, *Nees.*

EXPLANATION OF THE PLATES.

Plate XIV.

R. ferruginosus, Link.

Fig. 1. Vertical section of old culm, showing the thick epidermal cells and two of the funnel-like cavities resulting from the breaking down of the resin-containing cells. The epidermal cells overlie a thick spongy layer of cellular tissue, &c. (see p. 222).

Fig. 2. Transverse section of old culm, showing the same tissues as in fig. 1.

Fig. 3. Vertical section of young culm to show the epidermal cells, and the cellular layer beneath.

Fig. 4. Transverse section of cortical tissues from culm rather older than in fig. 3. The subepidermal cells still retain their chlorophyll, but are beginning to assume the lengthened form and spongy texture characteristic of the old culm.

(All the figures magnified to about 200 diameters.)

Plate XV.

R. Harveii, Mast. (see p. 253).

Fig. 1. Plant, nat. size.

Fig. 2. Spikelet, magnified.

Fig. 3. Bract.

Fig. 4. Unexpanded flower.

Fig. 5. Outer lateral glume (conduplicate), anterior glume, and one of the inner glumes.

Fig. 6. Ovary and staminodia.

Fig. 7. Culm-sheath.

Observations on some Orchids of the South of France. By John Treherne Moggridge, Esq. Communicated by the President.

[Read Nov. 3, 1864.]

[Plate XVI.]

During the past winter and spring spent in the South, I had some opportunities of observing the Orchidaceæ of those parts, and noting down what seemed to me strange and new about them. The 'Fertilization of Orchids,' by Charles Darwin, Esq., was of course the base upon which I worked, and which thus opened out for me a fresh and most delightful source of occupation.

Orchis longibracteata, Bivona (*Aceras longibracteata*, Grenier and Godron), is the first orchid which comes into flower; and as it commences blossoming on or before New Year's day, a long period is allowed over which to extend one's investigation. I propose, therefore, to show first how that plant is adapted for fertilization, and what insect is an agent in the matter. The caudicles of the pollinia are united on to one common gland (as in *Orchis pyramidalis*), and placed in a pouch, which stands higher with reference to the surface of the labellum than in any Orchis I have examined. This elevation admits of the interference of a larger and stronger insect—of just such a one, in fact, as *Xylocopa violacea*, a specimen of which I had the good fortune to see taken, bearing the pollinia of this species fastened on its forehead. By reference to Pl. XVI. fig. 1*a*, the relative positions of the large pear-shaped stigmatic cavity of the pouch, and the labellum will be seen. In the dissection of this (*b*) the greater part of the labellum has been removed, leaving one of the small guiding-plates on the further side. When first taken the pollinia are widely separated and upright (*c*); but by convergence the masses are soon drawn together (*d*), and then prostrated (*e*). The motion in either plane is, in unmutilated specimens, distinct, the prostration always setting in after convergence. For comparison, I have drawn (fig. 3) a similar view of *Orchis hircina*, with a foreign specimen of which I have been favoured since my return to England. *Orchis hircina* has the pouch very low in the flower; and the structure will be seen to vary in several other details. Its pollinia, judging from those furnished by that spike alone, accomplish their convergence during their prostration, and not by separate motions.

I have myself seen *Orchis longibracteata* visited by several species of Hymenopterous and Dipterous insects; and I feel sure that

many of the more minute Ephemeræ are attracted by this and some other Orchidaceæ, as a small spider of a colour wonderfully matched to the flowers or bracts constantly spins his web round the spike, the threads passing in front of the stigmatic chamber. On one occasion I had a close view of a Dipterous insect at work on the labellum of a flower of *Orchis longibracteata*; the plant, being in a pot on a balcony, was raised to the level of my eye. I saw that the proboscis was dipped into each of the open cells of honeycomb texture, and instantly withdrawn; but, judging from the lengthy stay of the insect on the flower, it found in these tiny glistening cavities some liquid worth its search. Being anxious to ascertain whether the spikes were more attractive to the agents of fertilization at any definite stage of the blossoming, I made the following notes. I must premise that, by the average number of blossoms, those on any one spike may be taken as about 30, but they range from 15 to 50.

Date of gathering.		Number of expanded flowers.	Number of stigmas touched.	Number of pairs of pollinia taken.
March 1.	Spike No. I.	18	4	0
	„ „ II.	7	2	0
	„ „ III.	11	1	0
„ 7	Spike No. I.	12	1	4
	„ „ II.	10	5	0
	„ „ III.	5	3	2
	„ „ IV.	10	0	0
	„ „ V..........	16	2	0
	„ „ VI.	8	1	0
	„ „ VII.......	11	3	3
	„ „ VIII. ...	12	2	3
„ 8.	Spike No. I.	10	1	3
	„ „ II.	23	4	5
	„ „ III.	34	7	7
	„ „ IV.	36	10	9
	„ „ V..........	24	0	0
„ 10.	Spike No. I.	46	13	22

A plant of this Orchis placed by me in the shade had no pollinia removed or stigmas fertilized; and I notice that this is frequently the case in places where the sun does not strike. When I found that the blossoms on this spike were beginning to fade (which was not till the 59th day after the expansion of the first flower), I remarked that all the stigmatic tissue was quite dried up, with the exception of part of the surface of one quite at the top. I then touched the pouch of the flower 59 days old, and the gland immediately adhered; and though the caudicles were weak,

the movements were effected in about 3 minutes. The pollinia of succeeding flowers became gradually more and more efficient, and fertilized a fresh spike in the ordinary way. This shows that the pollinia may be removeable and useful after the spike on which they are is incapable of fertilization.

Fig. 2 represents a spike of *Serapias cordigera* (Linn.), a plant which has two pollinia united on one gland, as in the preceding, but possesses a complex and most interesting fertilization. On their withdrawal the masses are bent back away from the stigma (*b*), but quickly reverse and accomplish their depression and contraction as in *Orchis hircina*. The stigmatic cavity is exceedingly narrow and obscure; so that, though the column is enclosed in a somewhat tubular chamber formed by the upright anterior lobes of the labellum and the hood-shaped coherent segments of the flower, the pollen-masses on an insect's head would be very apt to miss coming in contact with its viscid surface at all. To remedy this, the guiding-plates (*a*, fig. 2) are raised into a two-walled glabrous trough, in which the masses slide without fail against the stigma. I secured a specimen of an insect (*Ceratina albilabris*) in the act of touching the stigma of this plant with the yellow pollen of *Serapias lingua*, two pairs of pollinia of which were fastened on its head; the gland of one pair partially covered the right eye.

In the case of *Xylocopa violacea* and *Ceratina albilabris*, therefore, we find the glands attached to their heads, not their proboscides; and it seems probable, as the height at which the pouch stands is most accurately in relation to that of the insect fertilizer, and as the flat glands are not easily removed by any narrow object or slight degree of pressure, that the elevation of the pouch is a feature of very great importance to the plants. My last observation concerns *Ophrys Scolopax* (Cavanilles), a plant very analogous to *O. Arachnites*. This plant appears under two forms in the two localities where I have obtained specimens. At Mentone I never saw any tendency to self-fertilization, but all the spikes of a large bundle sent me at Cannes were so without exception. This material difference between the two is accomplished by a very slight bend in the anther-cells, which are prolonged into a beak of variable length, in the case of the self-fertilizing blossoms. It is a remarkable coincidence, that at Mentone the Bee Ophrys is scarce, and at Cannes very abundant. So, within thirty miles of one another, we have one spot where self-fertilization is in full action, and another where it is, as far as I am aware, unknown.

On the Genera *Sweetia*, Sprengel, and *Glycine*, Linn., simultaneously published under the name of *Leptolobium*. By GEORGE BENTHAM, P.L.S.

[Read November 3, 1864.]

THE late Dr. Vogel, when working up Sello's Brazilian Cæsalpinieæ at Berlin in 1836–7, published in the 11th volume of the 'Linnæa,' under the name of *Leptolobium*, a genus which seemed to form the connecting link between Papilionaceæ and Cæsalpinieæ; for, among several species which were evidently inseparable as to genus, some had curvembryous and others rectembryous seeds, and there were likewise irregularities in the æstivation of the petals. During the same winter, and before Dr. Vogel's paper was published, I was occupied at Vienna with a general arrangement of Papilionaceæ, and described under the same name of *Leptolobium* an Australian genus of Phaseoleæ, for some species which had been erroneously referred to *Kennedya*, and which did not then appear to me to be reducible to any other previously described one. My paper was only printed after I had left Vienna, and in the meantime Vogel's appeared. Acknowledging therefore the right of priority of his *Leptolobium*, I changed the name of mine to *Leptocyamus*. It now turns out that neither of our genera are tenable, although neither he nor I could be aware of it in the then state of the materials at our disposal. Although the two genera to which they must be reduced have little else in common than the fortuitous circumstance of having been simultaneously described under the same name, I trust that that may be sufficient excuse for comprising their history in the same paper.

And first as to Vogel's genus. That careful observer found amongst Sello's specimens some very indifferent ones of Sprengel's *Sweetia fruticosa*, which, as afterwards admitted by Sprengel himself, had been erroneously described, and was believed by both botanists to be identical with *Acosmium lentiscifolium* of Schott. Vogel accordingly described it under that name in his above-mentioned paper, adverting to its close affinity to *Leptolobium*, but retaining it as distinct on account of some difference in habit, and the calyx shortly toothed only, not lobed, the pod being then unknown. Authentic specimens of both Sprengel's and Schott's plants now show that *Acosmium* is indeed a congener of *Sweetia*, but not quite identical, the flowers being longer, somewhat differently shaped, and the calyx-teeth much deeper, intermediate in this respect between Sprengel's plant and *Leptolobium*. As the pod moreover

proves to be quite that of *Leptolobium*, it follows that the whole must be united under one genus. Of the three names, Sprengel's has by many years the priority: the only objections to its adoption would be, first, that, owing to misdescription, it was not recognizable; and secondly, that a *Sweetia* was published by DeCandolle about the same time in the second volume of the 'Prodromus.' To the first objection it may be replied that, on the first occasion that the plant was met with and described, it was recognized by Vogel by means of authentic specimens; and to the second, that DeCandolle's *Sweetia* has been suppressed, having been ascertained to be no other than the common *Galactia tenuiflora*, W. & Arn. We are thus compelled to lay aside both Schott's and Vogel's names, and adopt Sprengel's dedication of the genus to our late laborious horticultural illustrator.

The genus, notwithstanding the anomalies which he did not fail to perceive, was placed by Vogel in Cæsalpinieæ; and in the rough sketch I made in 1840 (Hook. Journ. Bot. ii. p. 72) of an arrangement of that suborder I left it there, without having occasion to examine it in detail. It was thus omitted in the monograph of Brazilian Papilionaceæ which I published in Martius's 'Flora Brasiliensis.' But having now, in working up the order for our 'Genera Plantarum,' dissected several flowers of all the species we possess, I find that there is no doubt of its much closer affinity with the tribe Sophoreæ of Papilionaceæ. The æstivation of the petals, the main point of distinction between the two suborders, is essentially papilionaceous—the upper petal (vexillum) outside, then the two lateral ones, and the two lower inside: the exceptions, which I had formerly thought frequent in the genus, I find to be very rare, and only amount to this, that the vexillum is occasionally overlapped on one side by one of the wings; the two lowest or carinal petals I always find innermost. The other important character, the embryo, has in some species the straight radicle of Cæsalpinieæ, but in others it is curved or inflexed as in Papilionaceæ, a diversity which is not unfrequent in Sophoreæ—*Sophora* itself, for instance, having both straight and curved embryos, whilst the incurved radicle has as yet never been observed in true Cæsalpinieæ*. In other characters the habit resembles that of *Sclerolobium* and other Cæsalpinieæ, but is not unlike that of *Diplotropis* and others in Sophoreæ; the calyx, as in Sophoreæ, has the sepals united in a tube above the disk, which, although occasional, is very rare in Cæsalpinieæ; and the nearly regular corolla, which

* Swartzieæ, which have an incurved radicle, must be removed to Papilionaceæ.

at first sight is characteristic of Cæsalpinieæ, occurs also in *Barklya, Cadia*, and several other Sophoreæ; the flat coriaceous indehiscent pod with thin edges occurs in Dalbergieæ and Sophoreæ, as well as in Cæsalpinieæ.

I have now only to subjoin short diagnoses of the several species contained in the Kew herbaria.

SWEETIA, *Sprengel*.

CHAR. GEN.—*Calycis* turbinato-campanulati dentes vel lobi valvati aut vix imbricati. *Petala* 5, subsimilia, erecto-patentia, imbricata, summo exteriore. *Stamina* 10, libera, parum inæqualia, exserta; *antheræ* uniformes. *Ovarium* sessile vel breviter stipitatum, 2–4-ovulatum; *stylus* filiformis, stigmate parvo vel truncato terminali. *Legumen* plano-compressum, coriaceum vel membranaceum, indehiscens. *Semina* plano-compressa, exalbuminosa; radicula nunc brevis et recta nunc longior et incurva vel inflexa.—Arbores. *Folia* pinnata, foliolis coriaceis; stipulæ parvæ vel inconspicuæ. *Flores* parvuli, racemosi, racemis ad apices ramorum paniculatis. *Bracteæ* et *bracteolæ* angustæ vel minutæ, sæpius caducissimæ.

Sect. I. *Acosmium.* Calycis dentes seu lobi tubo breviores. Embryonis radicula incurva v. inflexa.

1. S. FRUTICOSA, *Spreng. Syst.* ii. 213. Foliolis (multijugis?) parvis oblongis nitidis venosis, racemis gracilibus puberulis, calyce brevissime dentato, petalis calyce duplo longioribus, vexillo latissimo.—Acosmium lentiscifolium, *Vog. in Linnæa*, xi. 395, non *Schott*.

Hab. Rio Janeiro, *Sello*.

The specimens are all in the same state as those seen by Vogel, in flower only, without leaves, except a few loose fragments, showing leaflets of 3 to 4 lines; the petals are much shorter and broader than in *S. lentiscifolia*.

2. S. LENTISCIFOLIA, *Spreng. Syst. Cur. Post.* 406. Foliolis multijugis oblongis nitidis venosis, racemis gracilibus pubescentibus, calycis dentibus tubo vix brevioribus, petalis calyce subtriplo longioribus, vexillo paulo latiore.—Acosmium lentiscifolium, *Schott, in Spreng. l. c.*—Foliola $\frac{1}{2}$–1 poll. longa, basi oblique angustata. Petala longe unguiculata. Filamenta gracilia. Legumen tenue, glabrum, nunc pollicare 1-spermum, nunc 2-pollicare 2-spermum, inter semina valde contractum (ovulo tertio intermedio abortiente?). Semina plana, oblonga, sub apice lateraliter affixa; cotyledones oblongæ; radicula longiuscula basi inflexa, cæterum recta.

Hab. Province of Rio Janeiro, *Schott*.

Sect. II. *Mesitis*, Vog. Calycis lobi tubo longiores. Embryonis radicula incurva accumbens.

3. S. BIJUGA. Foliolis 4–8 ovali-oblongis reticulatis subtus glaucis,

racemis brevibus puberulis, legumine tenui glabro.—Leptolobium bijugum, *Vog. in Linnæa*, xi. 391.—Foliola 1–2-pollicaria, coriacea, nitida, impari sæpius deficiente. Flores magnitudine eorum *S. dasycarpæ*; petala calyce dimidio longiora, vexillo breviore et latiore.

Hab. Between Victoria and Bahia, *Sello*; Ilheos, *Lushnath, Mart. Herb. Fl. Bras.* n. 1322.

Sect. III. *Leptolobium.* Calycis lobi tubo æquales v. longiores. Embryonis radicula brevis, recta.—Foliola in omnibus excepta *S. Gardneri* obtusissima vel emarginata. Florum alabastra in 4 prioribus subpyriformia, in 3 ultimis magis globosa.

4. S. BRACHYSTACHYA, sp. n. Foliis glaberrimis, foliolis 5–9 parvis ovato-oblongis opacis subtus pallidis, racemis brevibus laxe subcorymbosis puberulis.—Foliola $\frac{1}{2}$–$\frac{3}{4}$-pollicaria, retusa. Flores fere *S. nitentis*. Petala parum inæqualia. Legumen ignotum.

Hab. Serra da Lapa, *Riedel.*

5. S. DASYCARPA. Foliis subtus vel utrinque velutino-pubescentibus, foliolis 3–7 ovatis rigidulis venosis, panicula ampla pubescente, calyce basi attenuato, legumine tenui pubescente.—Leptolobium dasycarpum, *Vog. in Linnæa*, xi. 388.—Foliola 1$\frac{1}{2}$–3-pollicaria.

Hab. Apparently common in a great part of Brazil from Minas Geraes to Para, *Gardner*, n. 2543 & 3116; *Blanchet*, n. 3114, and many other collectors.

Leptolobium lanceolatum, Tul. in Arch. Mus. Par. iv. 118, seems to be a slight variety of *S. dasycarpa.*

6. S. GLABRIFOLIA. Foliis glabris vel subtus parce puberulis, foliolis 3–5 ovatis rigidulis venosis, panicula ampla pubescente, calyce basi attenuato, legumine tenui glaberrimo.—Leptolobium glabrifolium, *Tul. in Arch. Mus. Par.* iv. 118; L. tortuosum, *Mart. Herb. Fl. Bras.* n. 1151; L. elegans var. grandiflorum, *pl. exs. ex herb. Berol. distributæ.*

Hab. Provinces of Minas Geraes and Piauhy.

Perhaps a variety of *S. dasycarpa.*

7. S. NITENS. Foliis glaberrimis, foliolis 7–9 ovatis vel elliptico-oblongis rigidulis nitidis vix venulosis, racemis densis puberulis, calycis lobis summis latissimis, legumine crassiusculo coriaceo glabro.—Leptolobium nitens, *Vog. in Linnæa*, xi. 394; L. nitidulum, *Miq. Stirp. Surin.* 18.—Foliola 1–3-pollicaria.

Hab. British Guiana, *Rob. Schomburgk*, 1st coll. n. 526, 2nd coll. n. 239 & 457; *Rich. Schomburgk*, n. 379 & 730. Surinam, *Hartmann*, n. 1126. Rio Negro and Santarem, *Spruce*, n. 921. Vasiva River, *Spruce*, n. 3310.

8. S. ELEGANS. Glaberrima, foliis 5–11 ovatis v. ovali-oblongis tenuiter coriaceis nitidis oblique venosissimis, racemis laxiusculis brevibus, legumine tenui glabro.—Leptolobium elegans, *Vog. in Linnæa*, xi. 390.—Foliola 1 2-pollicaria.

Hab. Provinces of Minas Geraes and S. Paolo, *Sello*, and others; *Mart. Herb. Fl. Bras.* n. 1150.

9. S. Panamensis, sp. n. Glabra vel tenuissime puberula, foliolis 5–11 ovatis vel ovali-oblongis rigidulis nitidis tenuiter venulosis, racemis laxiusculis puberulis, legumine tenui glabro.—Foliola 1–2-pollicaria.

Hab. Paraiso station, Panama railroad, *Sutton, Hayes.*

This species has the foliage nearly of *S. nitens*, with the fruit of *S. elegans.*

10. S. Gardneri, sp. n. Glaberrima, foliolis 3 ovatis vel elliptico-oblongis breviter acuminatis tenuiter coriaceis nitidis venosissimis, racemis laxis breviter paniculatis.—Foliola nunc 1½–2-pollicaria, nunc duplo fere majora. Racemi numerosi, panicula tamen foliis brevior. Alabastra ut in speciebus 2 præcedentibus fere globosa, calyce basi brevissime tantum attenuato. Petala inter se subæqualia. Legumen ignotum.

Hab. Prov. Pernambuco, *Gardner*, n. 962.

Leptolobium tenuifolium, Vog. in Linnæa, xi. 391, which I have not seen, appears to me to be very doubtful. It is described as differing from the others in its membranous leaves and broader petals. It was gathered by Sello between Campos and Victoria.

Leptolobium ? leiocarpum, Vog. in Linnæa, xi. 393, described from fruiting specimens only, and therefore left doubtful, proves to be the fruiting state of *Apuleia præcox*, Mart.

Leptolobium ? punctatum, Benth. in Linnæa, xxii. 526, described from indifferent specimens in flower only, is *Myrocarpus frondosus*, Allem., a distinct genus, but of which the position in the system, either next *Sweetia* in Sophoreæ, or as an anomalous Cæsalpiniea, is as yet doubtful. The flowers are too fully out to ascertain the æstivation, especially as the petals are exceedingly narrow linear.

The genus *Leptolobium* or *Leptocyamus*, which I had proposed, is reducible to *Glycine*, Linn., as now most conveniently limited. Up to the time of DeCandolle's 'Prodromus,' the genera *Glycine* and *Dolichos* had become receptacles for all Phaseoleæ which had no very striking character to distinguish them. DeCandolle, in reforming the order, eliminated most of the anomalous species which had been referred to *Glycine* for want of a better place, and established a somewhat better-characterized group of small-flowered slender Phaseoleæ, distinguished from *Galactia* chiefly by the calyx. He still retained, however, two distinct types, afterwards well separated by Arnott (in Wight and Arn. Fl. Penins. Ind. Or.)—one with the alternate stamens abortive and a remarkably

hooked pod, the other with the stamens all perfect and the pod straight or slightly incurved at the end—the one represented by *G. labialis*, Linn. f., the other by *G. javanica*, Linn. Not being aware that either group had been previously published as a genus, Arnott retained the name of *Glycine* for the former, as containing the commonest and most widely spread species, and gave to the latter the new name of *Notonia*, which he afterwards changed to *Johnia* on perceiving that DeCandolle had already published a *Notonia* in Compositæ. This nomenclature was unfortunate; for recent investigations have shown that *Glycine* so limited not only excluded all the species of the elder Linnæus, but was identical with *Teramnus*, Swartz, adopted in the 'Prodromus,' and that *Johnia*, on the other hand, comprising *G. javanica*, Linn., which had never yet been generically separated, had much more legitimate grounds for retaining the Linnean name. It is true that *G. Soja*, Sieb. & Zucc. (*Dolichos Soja*, Linn.), which I now propose to restore to the same group, had been adopted as a genus by DeCandolle after Mœnch; but even supposing the union now proposed to be generally acquiesced in, the law of priority would doubly sanction the retaining as *Glycine* a species of the elder Linnæus in preference to one of his son's, and the adoption of Swartz's separate genus in preference to Mœnch's. To *Glycine* as thus limited must be referred my *Leptolobium* or *Leptocyamus*. As Australian, and as having been formerly published under *Kennedya*, it only occurred to me at the time, with the limited materials then at my disposal, to compare it with that genus, more especially as the flowers are usually solitary under each bract, not clustered two or three together as in Arnott's *Johnia*; but this character is accompanied by no other one, is not always constant, and appears wholly insufficient to be considered as otherwise than sectional where the habit is so very similar.

The genus *Teramnus*, Sw. (*Glycine*, W. & Arn.), of which I have given a detailed character in Martius's 'Flora Brasiliensis,' comprises the four or five following species.

1. T. VOLUBILIS, *Swartz*. Foliolis oblongis lanceolatisve subtus sericeis pubescentibusve, calycis labio superiore brevissime bidentato, vexillo basi angustato, alis utrinque angulato-dentatis carina subduplo longioribus, legumine adpresse piloso.

Hab. Tropical America.

2. T. UNCINATUS, *Swartz*. Foliolis oblongis lanceolatisve vel imis ovatis subtus sericeo-villosis, calycis laciniis 5 æqualibus, vexillo basi angus-

tato, alis obtuse unidentatis carina duplo longioribus, legumine dense villoso.

Hab. Tropical America and Mexico.

The synonymy and a detailed description of the above two species are given in Martius's 'Flora Brasiliensis,' Papilionaceæ, pp. 137, 138.

3. T. LABIALIS, *Spreng. Syst.* ii. 235. Pube adpressa vel in inflorescentia patente, foliolis ovatis oblongisve, calycis labio superiore profunde bifido, vexillo basi angustato, alis unidentatis carina triente longioribus, legumine adpresse piloso vel glabro.

Very widely spread over the warmer regions of Africa and Asia. See the description and synonymy given under *Glycine labialis*, Linn. f., by Wight and Arn. Fl. Penins. Ind. Or. p. 208, to which may be added also the following synonyms:—*Glycine Warreensis*, Dalz. in Hook. Kew Journ. iii. 210; *G. senegalensis*, DC. Prod. ii. 242; *G. abyssinica*, Hochst., A. Rich. Fl. Abyss. i. 212 (*Kennedya arabica*, Hochst. et Steud. Pl. Exs.); *Bujacia gampsonychia*, E. Mey. Comm. Fl. Afr. Austr. 127; *Glycine gampsonychia*, Walp. in Linnæa, xiii. 533.

4. ? T. MOLLIS, *Benth.* Foliis subtus sericeis, inflorescentia patentim pilosa, calycis labio superiore bidentato, vexillo basi rotundato, alis unidentatis carina triente longioribus, legumine longe piloso.—Glycine mollis, *Wight et Arn. Prod. Fl. Penins.* 208 (ex parte).

Hab. Indian peninsula, Ceylon, Prome.

Some of the specimens included by Wight and Arnott under *G. mollis*, especially those of the Courtallum collection, n. 221, appear to me to be a variety only of *T. labialis*; but the majority, including those of the Courtallum collection, n. 222, may possibly be really distinct, in the upper lobes of the calyx united nearly to the top and a differently shaped vexillum.

5. T. FLEXILIS, *Benth.* Glabrescens, foliolis ovatis amplis, racemis brevibus confertifloris, calycis dentibus 5 tubo brevioribus, legumine glabro.—Glycine flexilis, *Wall. Cat. Herb. Ind.* n. 5521.—Caules alte volubiles, retrorsum pilosi, demum glabrati. Foliola 4–5 poll. longa, 2–3 poll. lata, utrinque glabra vel subtus pilis raris præsertim ad venas conspersa. Racemus fructifer petiolo brevior. Legumina pleraque 3 poll. longa, 2 lin. lata, plano-compressa, apice breviter uncinata.

Hab. Silhet and Assam, *Wallich, Jenkins.*

This species is at once distinguished by the large size of all its parts. The specimens are all past flower, and I have not seen the petals; but the persistent calyx and stamens, with the alternate anthers reduced to small capitate staminodia, and the hooked pod leave no doubt as to its genus.

Of the genus *Glycine* as I propose to limit it, and of the six species of the section *Leptolobium*, characterized by the flowers distinct from each other, not clustered along the rhachis, full characters are given in my 'Flora Australiensis,' ii. 242. Besides these, the genus would include five others, characterized as follows.

Sect. *Soja*. Flores fasciculati. Legumen latiusculum, rectum vel falcatum, inter semina non depressum.

1. G. SOJA, *Sieb. et Zucc. Fam. Nat. Fl. Japon.* ii. Villosa, floribus fasciculatis, inferioribus axillaribus, racemis superioribus folio brevioribus, corolla calyce pæne dimidio longiore, legumine latiusculo falcato 2–3-spermo.—Soja hispida, *Mœnch, DC. Prod.* ii. 396.

Cultivated; and spontaneous on the margins of fields and cultivated places over a great part of tropical Asia.

2. G. HEDYSAROIDES, *Willd., DC. Prod.* ii. 241. Molliter pubescens, floribus axillaribus fasciculatis, corolla calyce pæne dimidio longiore, vexillo pubescente, legumine leviter falcato 5–6-spermo.—Johnia Willdenowii, *Hook. f. Fl. Nig.* 305; Teramnus hedysaroides, *Spreng. Syst.* iii. 235.

Hab. W. tropical Africa, *Thonneig, G. Don,* and others.

3. G. PENTAPHYLLA, *Dalz. in Hook. Kew Journ.* iv. 344. Sericeo-puberula vel glabrescens, foliolis sæpius 5, floribus in racemo elongato fasciculatis, calyce basi obtuso, dentibus brevissimis, ovario sub-4-ovulato, legumine obliquo vel subfalcato.

Hab. Concan, *Dalzell, Stocks*; Khasia, *J. D. Hooker and Thomson.*

4. G. LYALLII, *Benth.*, sp. n. Pubescens vel rufo-villosa, foliolis 5–7, floribus in racemo elongato fasciculatis, calyce basi postice gibbo, laciniis tubo vix brevioribus, ovario 6–8-ovulato, legumine rectiusculo.—Caules tenues, volubiles. Foliola nunc ovata, terminali subpollicari, lateralibus minoribus, nunc lanceolata, terminali sæpe 2-pollicari vel longiore. Racemi axillares 2-pollicares et longiores. Flores per 2–5 fasciculati, magnitudine eorum *G. javanicæ*. Pedicelli raro lineam longi. Petala 3-lin., glabra; vexillum a cæteris remotum, ungue incurvo calycis tubum æquante; alæ et carina oblongæ, vexillo subæquilongæ. Legumen 3–4 poll. longum, 4–5 lin. latum, rectum vel leviter falcatum, cuspidatum. Semina 4–6, transverse oblonga.

Hab. Madagascar, *Lyall, Bréon*. Province of Emirna, *Bojer*. Island of Ambongo, off the coast, *Perville*.

Sect. *Johnia*. Flores fasciculati. Legumen rectiusculum, demum transverse inter semina depressum.

5. G. JAVANICA, *Linn., DC. Prod.* ii. 242. Villosa, racemis folio longioribus, floribus fasciculatis, corolla calyce dimidio longiore, legumine 3–6-spermo lineari rectiusculo inter semina transverse lineato.—Johnia Wightii, *W. et Arn. Prod. Fl. Penins.* 449; Soja javanica et S. Wightii, *Grah. in Wall. Cat.* n. 5528, 5530; Bujacia anonychia, *E. Mey. Comm.*

Pl. Afr. austr. 127; Glycine moniliformis et G. micrantha, *Hochst. in A. Rich. Fl. Abyss.* i. 211 & 212.

Hab. Eastern Africa from Natal to Abyssinia, Ceylon and the Indian peninsula, including the specimens from Nilgherri, *Hohenacker*, n. 1594, distributed by some mistake on my authority under the name of *Shuteria vestita*.

Johnia Petitiana, A. Rich. Fl. Abyss. i. 210, t. 40, *Soja angustifolia*, Miq. Fl. Ind. Bat. i. part 1. 223, and *S. hamata*, Miq. l. c. 224, are unknown to me.

On a new Genus of *Ternstrœmiaceæ*. By Captain R. H. Beddome, Officiating Conservator of Forests, Madras. Communicated by Dr. T. Thomson, F.L.S.

[Read November 17, 1864.]

[Plate XVII.]

Pœciloneuron.

Calyx 5-parted, divisions equal, imbricate; petals 5, contorted. Stamens about twenty on a tube surrounding the base of the ovary, which is either inconspicuous and entire or more prominent and 5-cleft so that the stamens are subpentadelphous; anthers erect, affixed by their base, long, linear. Styles 2, stigmas filiform. Ovary 2-celled; ovules 2 in each cell, erect. Capsule not known. Panicles terminal. Leaves opposite, with close parallel venation, minutely reticulated.

P. Indicum (Beddome). A tree. Leaves ovato-oblong, with a long acumination, glabrous; panicles terminal, many-flowered; flowers yellowish white; calyx, peduncles, and pedicels slightly puberulous.

Western slopes of the Nilgiris; 3000 feet elevation. A large tree, said to yield a valuable timber.

On the Naturalized Weeds of British Kaffraria. By W. S. M. D'Urban, Esq., F.L.S. In a letter to Dr. Hooker, V.P.L.S.

[Read November 17, 1864.]

Newport, near Exeter,
Nov. 3, 1864.

My dear Dr. Hooker,—You asked me last spring to draw up a Note on the Naturalized Weeds of British Kaffraria, and I fully intended to have complied with your request long ere this. I have, however, been so incessantly occupied with my Botanical Classes in Exeter and other engagements, that I have been un-

able until very recently to spare the time necessary to look up my notes on Kaffrarian botany dispersed through my journals. I hope the following notes will not be too late to be of some slight service to you. You must remember, in extenuation of the scantiness of my list of weeds and the small amount of information I have to supply you with, that I was resident only twelve months in the colony of British Kaffraria, and my time was mainly occupied with the Filices amongst plants and the Rhopalocera amongst insects, and their pursuit necessarily took me away a good deal from the neighbourhood of European cultivation, where alone, in a new colony, intrusive weeds are likely to be met with, though in the case of some few remarkably prolific and hardy species the whole country may be overrun by them.

I also suffered from the want of botanical works, Harvey's 'Genera of South African Plants,' Asa Gray's 'Manual of the Botany of the Northern and Midland States of America,' and Lindley's 'School Botany' being the only ones to which I had access.

British Kaffraria is still but an infant colony. King William's Town, the capital, was founded only about twenty-eight years since, and it was abandoned for some years, or until the Kaffir war of 1848, when it was again taken possession of by the British Government. The Rev. J. Brownlee, the first Missionary to the Kaffirs who succeeded in establishing himself amongst them, being an enthusiastic botanist and gardener, introduced most of the more valuable cultivated plants now growing at King William's Town, long before the province had been taken possession of by our troops. British Kaffraria is situated on the south-eastern coast of Africa, between the Keiskamma and Great Kei Rivers. King William's Town is 25 or 30 miles in a straight line from the sea-coast, and is in lat. 32° 52′ S., long. 27° 29′ E. The winter, from April to September, is the dry season, when rain rarely falls, and frosty nights occur occasionally. The summer is generally very wet, with frequent violent thunder-storms and sudden changes of temperature. I should not have made the few notes subjoined, had not the subject of the intrusion of weeds occupied my attention when exploring with Sir William Logan in the backwoods of Canada, where I was greatly interested by the gradual advance of the weeds accompanying European immigration into the very heart of the forests. They already form at least one-tenth of the somewhat scanty flora of the Laurentian rocks north of the Ottawa wherever a settlement has been formed, and all along the banks of rivers which lumber-men have ascended,

their seeds being dropped on the ice from the hay supplied to the horses employed in the winter traffic.

Most of the species I have enumerated in the annexed "List of Naturalized Intrusive Plants found in British Kaffraria" are thoroughly established and spreading with great rapidity, all of them freely increasing by seed. Indeed the luxuriance and prolificness of the garden weeds forced itself on my attention. For a short time after my arrival at King William's Town I occupied myself a good deal with gardening; but as the summer came on, it seemed such a hopeless task to keep down the weeds which choked the cultivated plants, that I abandoned the attempt in despair. In British Kaffraria amateur gardening soon succumbs to the droughts in winter and the weeds in summer.

I have not thought it advisable to include in my list certain garden flowers, such as *Eschscholtzia Californica*, *Œnothera biennis*,

List of Naturalized Intrusive Plants found in British Kaffraria.

Name of Plant.	Where found.	Duration.	Original native country.
Fumaria officinalis, Linn.	Cultivated ground.	Annual.	
Viola tricolor, Linn.	Gardens.	,,	Europe.
Stellaria media, Linn.	,,	,,	
Malva parviflora, Linn.	Waste places.	Perennial.	
Hibiscus Trionum, Linn.	Gardens, &c.	Annual.	South of Europe.
Tribulus terrestris, Linn.	,,	,,	
Medicago denticulata?, Willd.	,,	,,	
Vicia sativa, Linn.	,,	,,	Europe.
Agrimonia Eupatoria, Linn.	Roadsides.	Perennial.	
Portulaca oleracea, Linn.	Gardens.	Annual.	
Xanthium spinosum, Linn.	Roadsides, &c.	,,	Trop. America?
Bidens bipinnata?, Linn.	Gardens.	,,	N. America.
Sonchus oleraceus, Linn.	,,	,,	
Anagallis arvensis, Linn., var. *cærulea*	Waste ground.	,,	Europe.
Nicandra physaloides, Gaertn.	Gardens.	,,	S. America.
Physalis pubescens, Linn.	Gardens, waste places, and forests.	Perennial.	Trop. America.
Solanum nigrum, Linn.	Gardens.	Annual.	Europe.
Datura Stramonium, Linn.	Gardens and waste places.	,,	Trop. America.
—— (species)	Gardens.	,,	?
Chenopodium album, Linn.	,,	,,	Europe.
—— *Botrys*, Linn.	,,	,,	South of Europe.
—— (species)	Waste places.	Perennial.	?
Amaranthus albus, Linn.	Gardens.	Annual.	Trop. America.
—— *hypochondriacus*, Linn.	,,	,,	
Polygonum aviculare, Linn.	Waste places.	,,	Europe.
Emex spinosus	Gardens.	,,	S. Europe and N. Africa.
Ricinus communis, Linn.	Cultivated ground.	,,	Asia.
Urtica urens, Linn.	Gardens.	,,	
Panicum verticillatum, Linn.	,,	,,	
—— *glaucum*, Linn.	,,	,,	Europe.
Cynodon dactylon, Pers.	Waste places.	Perennial.	
Hordeum murinum, Linn.	,,	,,	

Zinnia elegans, Mirabilis Jalapa, Ipomœa purpurea, and *Canna Indica* (which spread themselves rapidly over gardens and become weeds where they have once been sown), because they are not generally diffused. Of the Morning Glory or *Ipomœa* at least four crops come up in the season; and its voluble habit renders it a most unwelcome plant in a flower-garden, in spite of its exquisitely beautiful flowers of every hue. It speedily smothers everything else, and from its rapid growth is most exhaustive to the soil.

You will see that, with the exception of five species, namely *Malva parviflora, Tribulus terrestris, Emex spinosus, Ricinus communis,* and *Hordeum murinum,* and two species whose original habitats are unknown to me, the whole of the thirty-two plants in my list are found in North America either native or naturalized, and many of them may therefore have been introduced from thence with the American garden seeds which are so largely imported into South Africa. Indeed this is the popular view of their origin in the colony itself. *Tribulus terrestris* and *Emex spinosus* are perhaps native weeds.

The *Fumaria* is that form of *officinalis,* Linn., called var. *Capensis,* and supposed by Dr. Sonder to be identical with *F. muralis* of the 'Flora Germanica.'

The *Medicago* has two to three coils in the pod, and is probably *denticulata,* Willd.

The Common Purslane (*Portulaca oleracea*) spreads itself in dense mats over the gardens in an astonishing manner. It is not, I think, generally known in England that the South African antelopes do not eat grass, but live entirely on succulent shrubs and bulbs. A tame Duiker Bok (*Cephalophus Grimmia*) confined in our garden at King William's Town previously to my arrival there had been fed principally upon "Spell-boom" or Tree-Purslane (*Portulacaria Afra*), a dwarf state of which is used as an edging to the flower-beds, but knowing its affinity with the Garden Purslane, I was induced to offer the latter to the Duiker, which ate it with great avidity. Might not this hint be useful to the authorities of the Zoological Gardens, who do not seem to have hitherto been particularly successful in the management of their South African antelopes, judging from the numerous deaths which have occurred amongst Sir George Grey's magnificent donations?

The Thorny Clotbur (*Xanthium spinosum*) has spread with such rapidity along the roadsides, around the military posts, and in all waste places, as to occasion great alarm amongst the sheep-farmers and others interested in the wool trade, the prickly involucre

forming the "bur" adhering to the fleece of any sheep coming into contact with it. Great exertions were being made when I left the colony in 1861 to exterminate this vile weed, which it was thought would greatly deteriorate the staple product of the country.

The Bur Marigold (*Bidens bipinnata*) is a most troublesome and annoying garden weed. It grows in great profusion, and reaches the height of several feet. Hardly anything can compete with it, except that equally vile and irritating plant the Bristly Foxtail Grass (*Panicum* (*Setaria*) *verticillatum*). These two weeds are enough to break the heart of a gardener; they grow and spread with such vigour and rapidity, that it is almost impossible to cope with them. The barbed awns on the achenia of the *Bidens* and the bristles of the spikelets of the *Setaria* alike pertinaciously adhere to one's clothes and are difficult to get rid of. The *Bidens* seemed to me to be *bipinnata*, but may possibly be some other species unknown to me.

Nicandra physaloides and *Solanum nigrum* are abundant in gardens. The soldiers stationed in the colony often eat the black berries of the latter, and they appear to be quite innocuous.

The well-known "Cape Gooseberry" (*Physalis pubescens*) was introduced about 40 years since into his garden at King William's Town by the Rev. J. Brownlee. It has spread in a wonderful manner, and by the agency of birds has been carried to the beautiful forests which fill the gorges or "Poorts" in the Buffalo Mountains about fourteen miles from King William's Town, and it has firmly established itself all along the lumber-roads made through the forest. The Fingoe women collect the smooth yellow berries and bring them to the markets for sale. They make a delicious preserve.

The Thorn Apple (*Datura Stramonium*) is a very disagreeable intrusive plant, not only from its heavy disgusting odour, but from its rank growth. There are two varieties equally common in gardens and waste places near houses. One variety has pale green stems and white flowers, and the other has the stems deep reddish purple and the flowers tinged with lilac. The latter I have seen 6 feet high in the soldiers' gardens at Tylden Post, about 70 miles north of King William's Town. It is probably the *D. Tatula*, Linn.

Datura, sp. I have not been able to ascertain the name of this species. It is a much-branched, strongly smelling annual, about 3 feet high, covered all over with viscid pubescence, and scurfy. Leaves opposite, or a leaf on one side of the stem and a branch

on the other, on long petioles, entire, ovate, subcordate at the base; base unequal. Flowers on short pedicels in the forks of the branches, erect, solitary; calyx 4 inches long, inflated, bilobed; corolla longer than the calyx, 5-plaited, -angled, and -pointed, pure white, sweet-scented. Stamens distinct; anthers not coherent round the style. Flowers from December to February, opening only in the evening or in cloudy weather, and is common in gardens.

The *Chenopodium* which I have left unnamed grows in the greatest profusion in every waste place about King William's Town. Its odour is exactly that of chloride of lime. It is a woody much-branched perennial with a leaf like that of *C. Botrys*, Linn. I am quite unable to discover its name. The native *C. Caroxylon*, Thbg., comes up in immense quantities on the sites of old Kaffir kraals and gives forth a most offensive odour. There are several weeds not mentioned in my list which are common in the western districts of the Cape Colony and about Graham's Town, but which I did not observe in Kaffraria; and I do not think they have yet penetrated there. These are *Capsella Bursa-pastoris*, *Erodium moschatum*, and *Oxalis corniculata*.

The Prickly Pear (*Opuntia vulgaris*, Mill.) was introduced during the Kaffir war of 1836 into Kaffraria as a means of defence against the natives; and it grows very freely, having become almost naturalized about old military posts. It is not so abundant as supposed, however; for many persons confound it with the tall prickly Euphorbias so characteristic of the Kaffrarian flora.

Amongst native plants which are met with about gardens as weeds I may mention *Lepidium myriocarpon* and a species of *Aizoon*.

A *Plantago* is common by roadsides and in waste places, but I do not know to what species it should be assigned.

Two species of *Commelyna*, the one with bright blue and the other with buff-coloured flowers, are complete weeds in damp places about houses and military posts. They are, I suppose, native species.

The Common Watercress has been introduced into the water-course which supplies the garrison with water at King William's Town, and is fairly established there.

Should these imperfect notes prove of any service to you, I shall feel flattered by your making any use you please of them.

Believe me, my dear Dr. Hooker,

Very truly yours,

W. S. M. D'Urban.

Note on the Variety *Trimmeri* of *Potamogeton trichoides*, Cham., found in England. By ROBERT CASPARY, Professor of Botany, Königsberg, Prussia. Communicated by Dr. HOOKER, V.P.L.S.

[Read December 15, 1864.]

AMONGST the Potamogetons of my herbarium is one, collected by my friend the Rev. Mr. Trimmer, of Norwich (Sept. 1850), in a pond near Framingham Earl, Norfolk, which I do not find mentioned in those British Floras I have at hand (Eng. Bot. cum Suppl.; Babington, Manual, 1843; Hook. & Arnott, Brit. Fl. 1850*), and which therefore may perhaps be new to England—*Potamogeton trichoides*, Cham. (Linnæa, 1827, ii. 275). I received this plant from Mr. Trimmer himself during my two years and a half's stay in England. It is not that variety of this species which Chamisso described and figured (*l. c.* tab. 4. fig. 6), and which was also represented by Reichenbach (Icon. Fl. Germ. 1845, vii. t. 21), and named by Ascherson (Fl. der Mark Brandenburg, 665) (*b*) *leiocarpus*, having only under the middle of the interior margin of the caryopsis a large tubercle, and a smooth carina ("fast ganzrändigen Kiel," Aschers.); nor is it that form which Fieber (Die Potamogetonen Böhmens: Prag, 1838, tab. 4. fig. 22) knew, and which Reichenbach mentions as *P. trichoides β. tuberculosus* (*l. c.* tab. 22. fig. 35); but it is a form intermediate between these two. The caryopsis of Fieber and Reichenbach's plant, *P. trichoides β. tuberculosus*, Reichenb., has a tubercled carina, and a large tubercle on either side of its base under the tubercle of the interior margin†. But the plant of the Rev. Mr. Trimmer, although it has well-defined tubercles on the back of the caryopsis, has no lateral tubercle below that of the interior margin. I designate this form as *P. trichoides* var. *Trimmeri*.

Königsberg in Pr.,
26 Nov. 1864.

[* The station for this plant near Norwich is given in the 7th edition of Hooker and Arnott's 'British Flora' (1855) and in the 4th edition of Babington's 'Manual' (1856). Dr. Caspary's critical notes, however, appear to be of sufficient interest to be placed on record.—ED.]

† It is possible that "*Potamogeton tuberculatum*," Tenore et Gussone (Memorie sulla Peregrinazione, lette alla R. Accad. delle Scien. 1834–38, Napoli, 1842, p. 150; Tenore, Sylloge, App. v., Napol. 1842, p. 4), which Ascherson, *l. c.*, unites with his *P. trichoides a. tuberculatus*, is synonymous with *P. trichoides β. tuberculosus*, Reichenb., as the caryopsis is represented "tuberculo unico utrinque" (Tenore, Syll. *l. c.*) and "ad carinam plurituberculata" (Ten. et Guss. Mem. *l. c.*); but as the leaf is described as "obtusiusculum" and the caryopsis as "obsolete reticulato-nervosa" (Ten. et Guss. *l. c.*), which is never found in *P. trichoides*, Cham., I cannot decide the question without seeing an

Extract of a letter from Professor W. H. Brewer, State Geological Survey of California, on the Forests of *Sequoia* (*Wellingtonia*) *gigantea*, addressed to Sir W. J. Hooker, F.R.S. & L.S.

[Read January 19, 1865.]

An interesting discovery this year has been of the existence of the big trees in great abundance on the western flanks of the Sierra Nevada, in about lat. 36° or 37°. They are very abundant along a belt at 5000–7000 feet alt., for a distance of more than twenty-five miles, sometimes in groves, at others scattered through the forests in great numbers. You can have no idea of the grandeur they impart to the scenery, where at times a hundred trees are in sight at once, over 15 feet in diameter, their rich foliage contrasting so finely with their bright cinnamon-coloured bark. I found trees larger than they occur further north (in the Calaveras and Maipura groves). The largest tree I saw was 106 feet in circumference at 4 feet from the ground. It had lost some buttresses by fire; it must have been at least 115 or 120 feet when entire; it is 276 feet high. The Indians tell of a much larger tree which I did not see.

There seems no danger of the speedy extinction of the species, as it is now known in quite a number of localities, and, contrary to the popular notion, there are immense numbers of younger trees of all sizes, from the seedling up to the largest. There has been much nonsense and error published regarding them.

I have no doubt of the true generic relations. I think that no one who is familiar with both species *in situ* would separate them generically from the *Sequoia sempervirens*, also abundant in this State, and fully as restricted in its distribution; nor do I think the names of *Wellingtonia* and *Washingtonia* would be insisted on with such zeal, were it not for seed-dealers and plant-collectors. I may remark that the seed-collectors on this coast have created endless confusion by naming species more for *profit* than from any honest conviction that they were new species.

I enclose a photograph by Watkins of the "Grizzly Giant," the largest tree in the "Maipura Grove" of Sequoias. It is a very characteristic tree, and is about 87 feet in circumference at 3 feet from the ground. During the past summer some fine photographs have been taken of the "Calaveras" big trees—the first-discovered grove.

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original specimen of *P. tuberculatus*, Ten. et Guss. The representation of this plant, which according to Tenore and Gussone is given by Boccone (Sic. p. 41, tab. 20. fig. 5), is so bad that it can only be guessed at, not determined.

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THE END.

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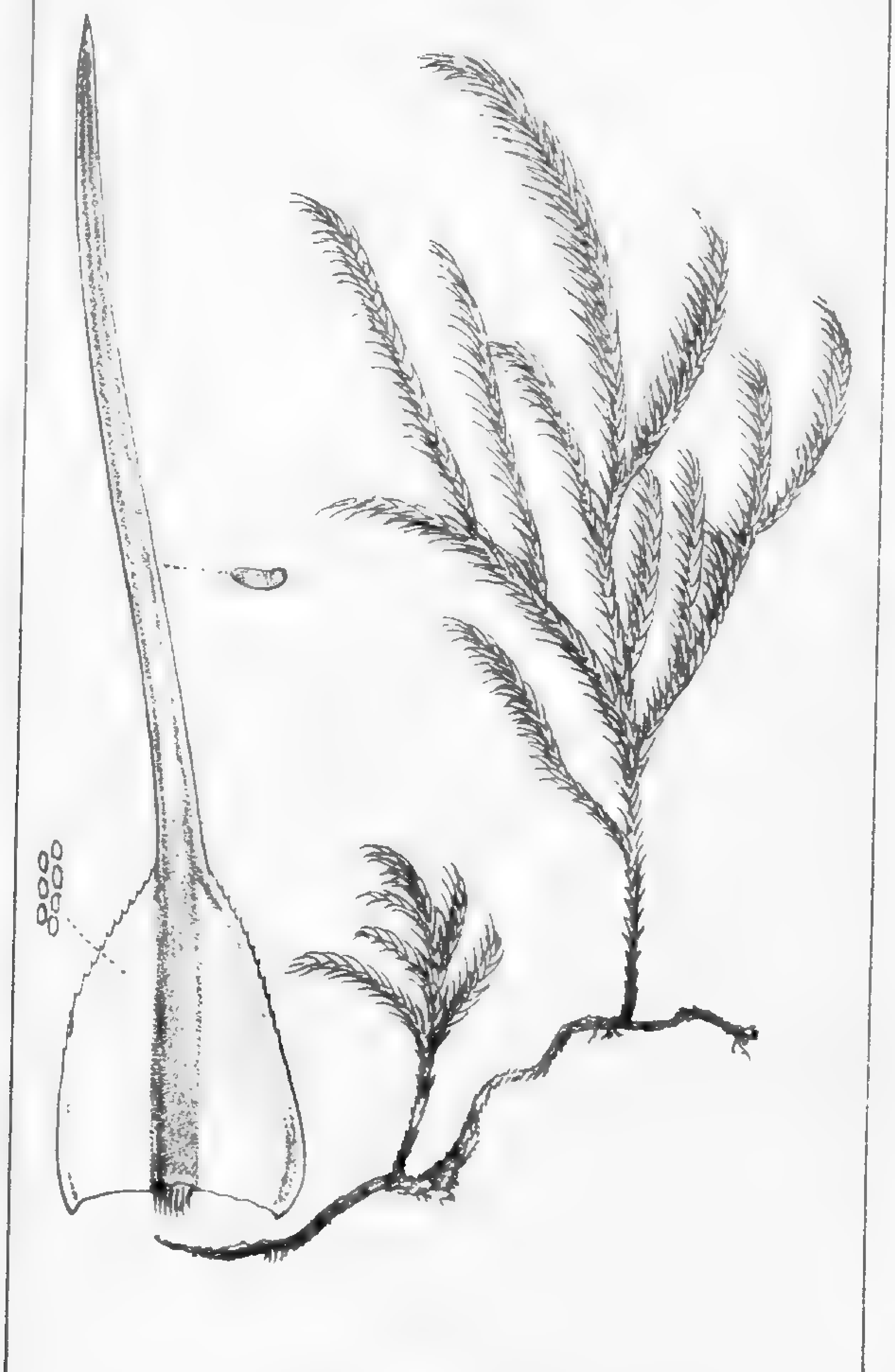
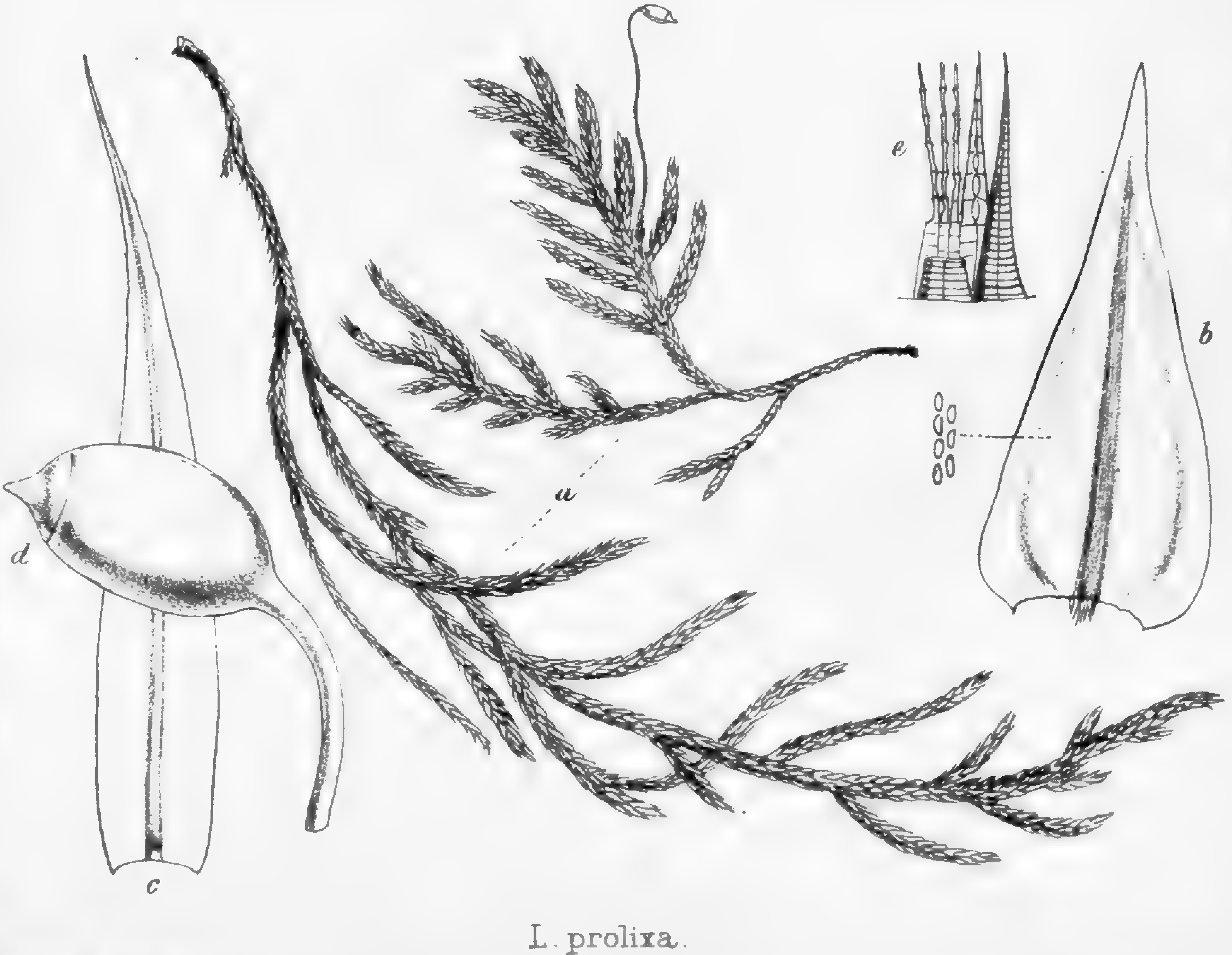
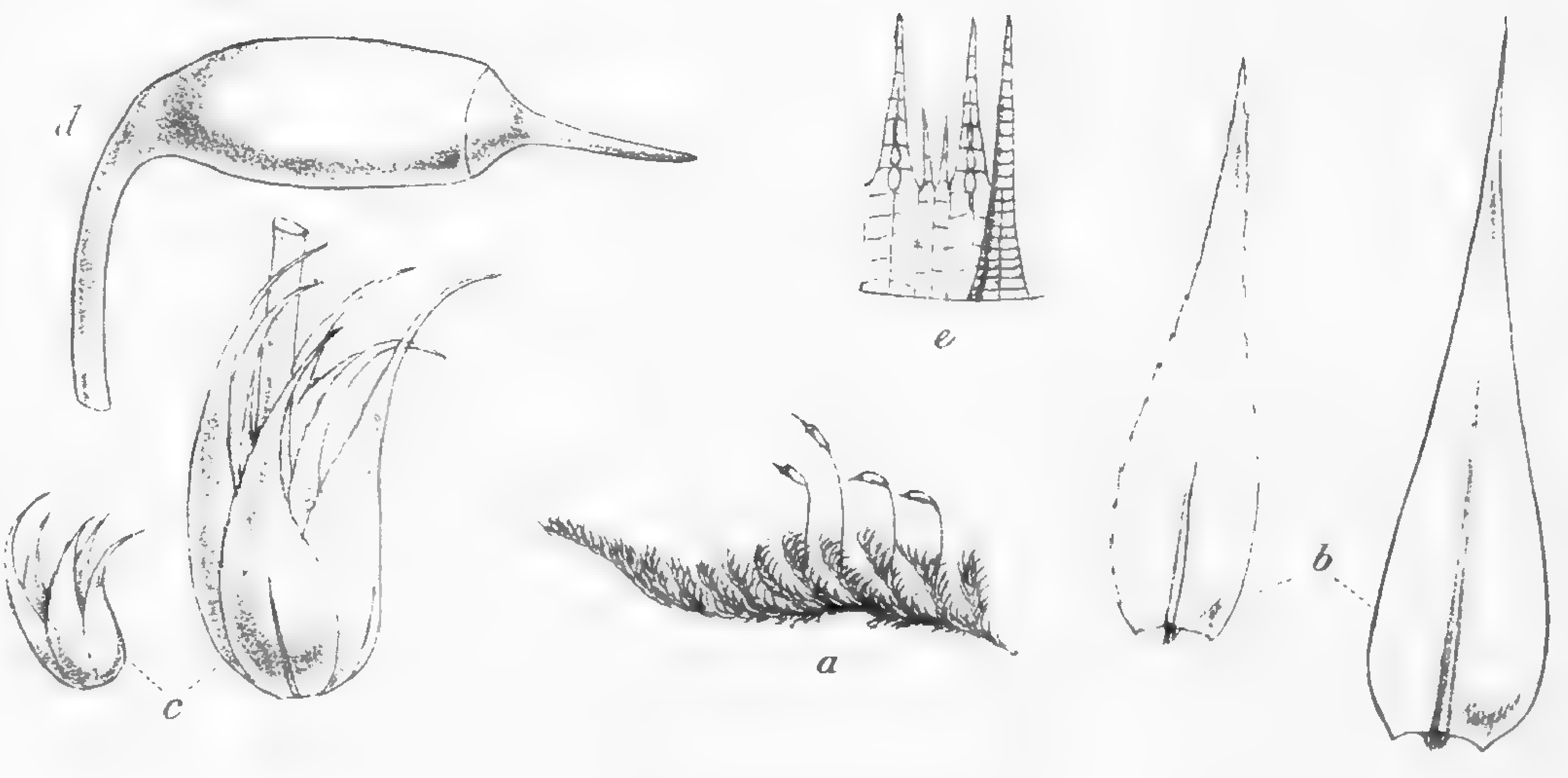


L. setigera

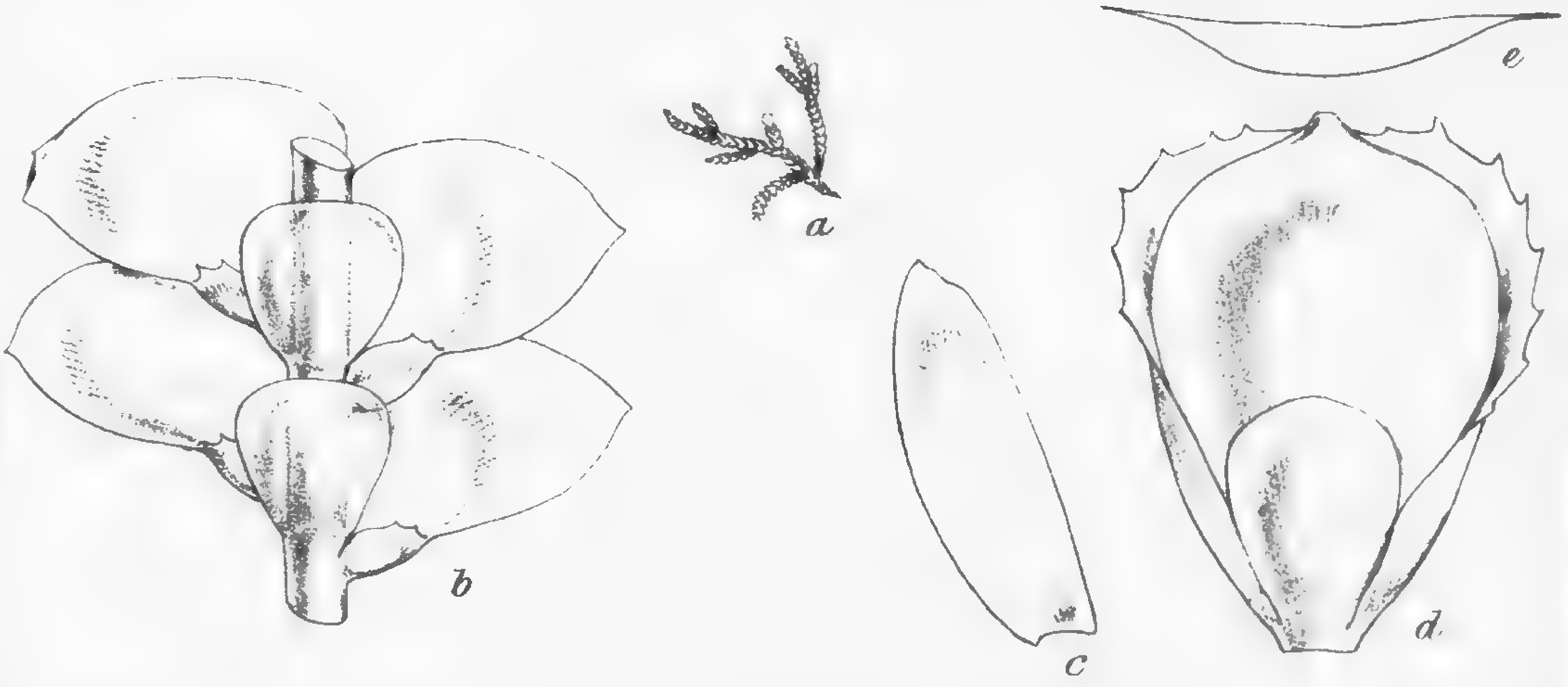
Leskea spinosa



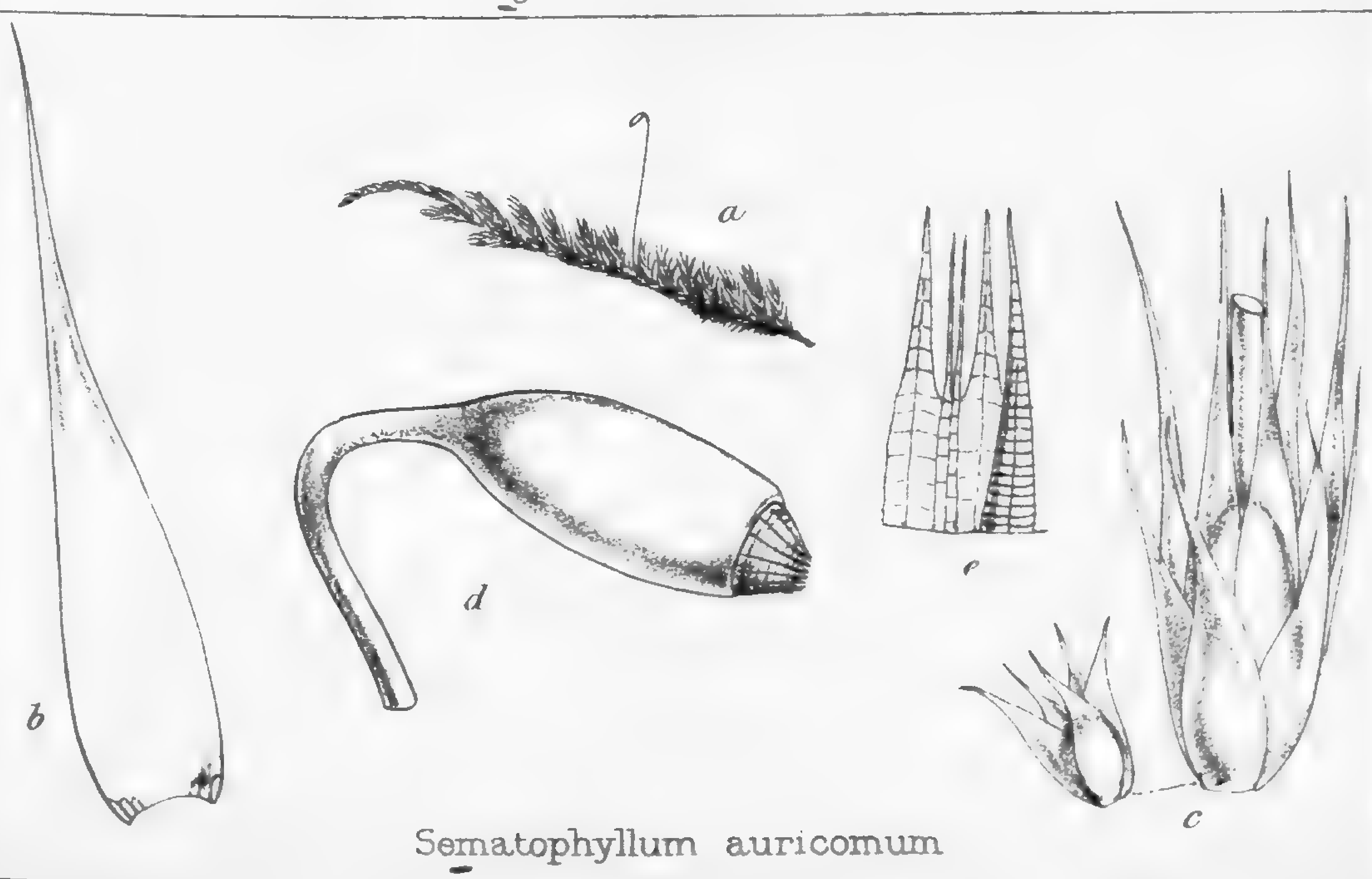
L. prolixa.



Hypnum surrectum.



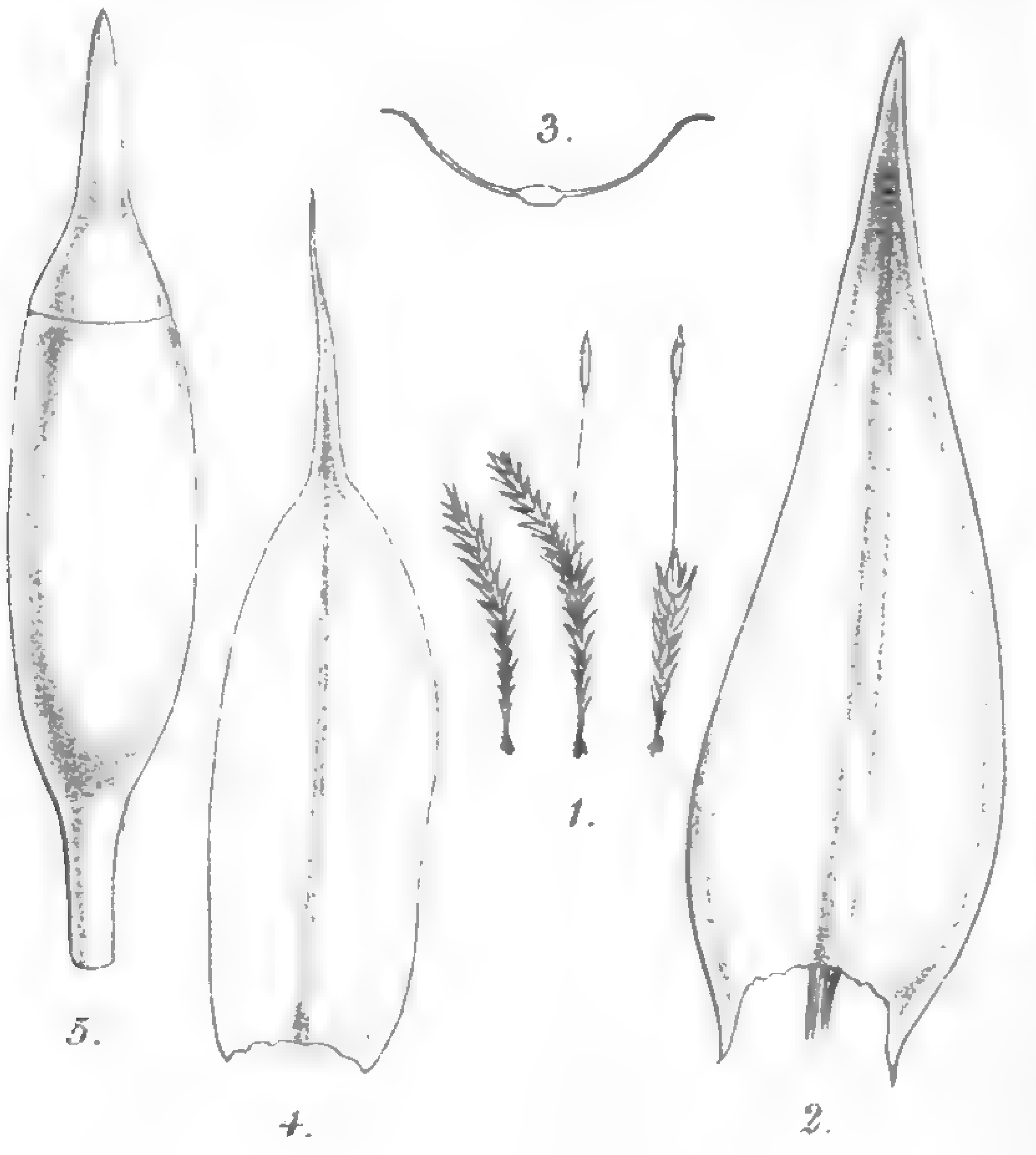
Lejeunia Johnsoniana.



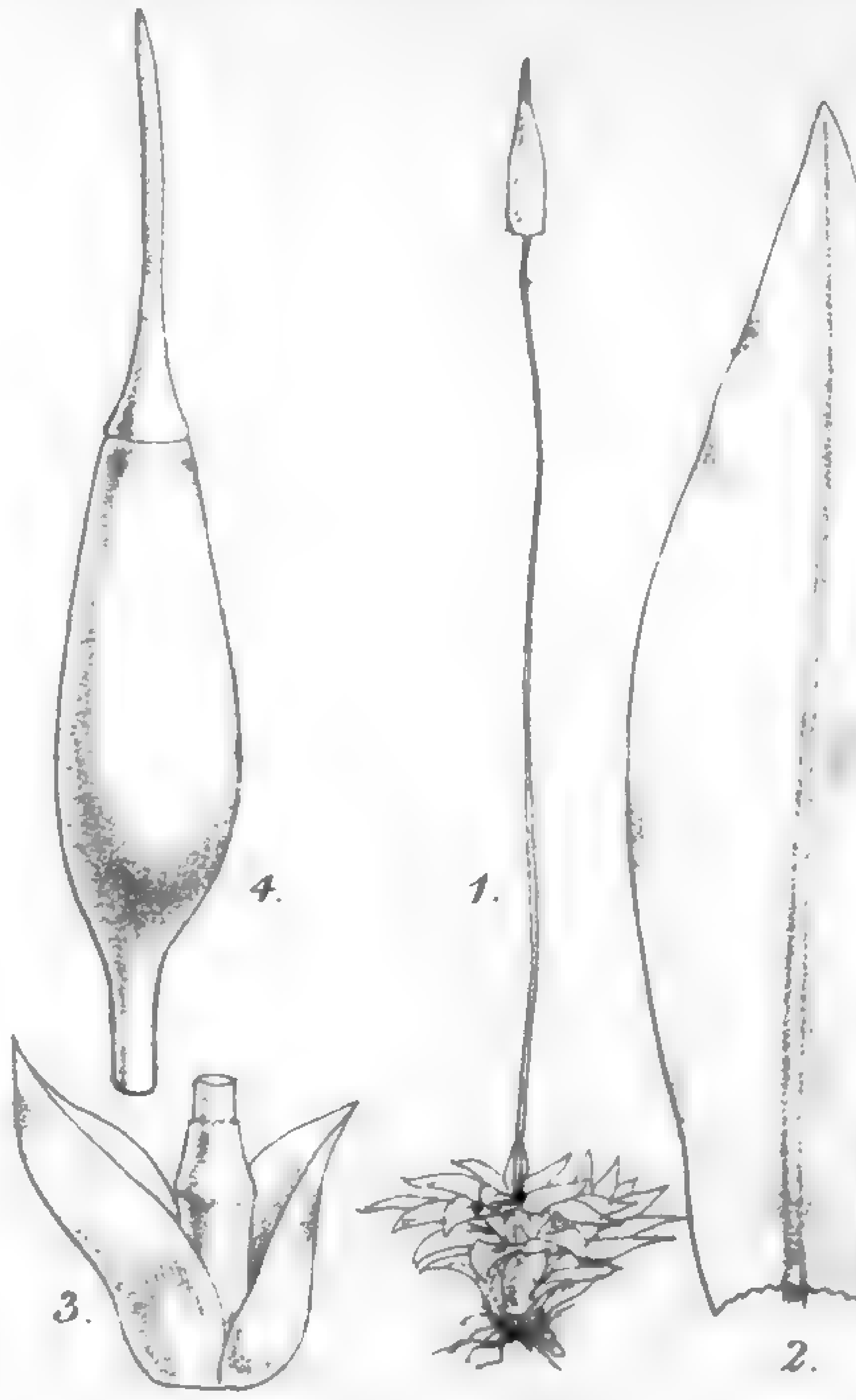
Sematophyllum auricomum

Frerea indica, *Dal.*

Brandisia discolor H.f. & T.

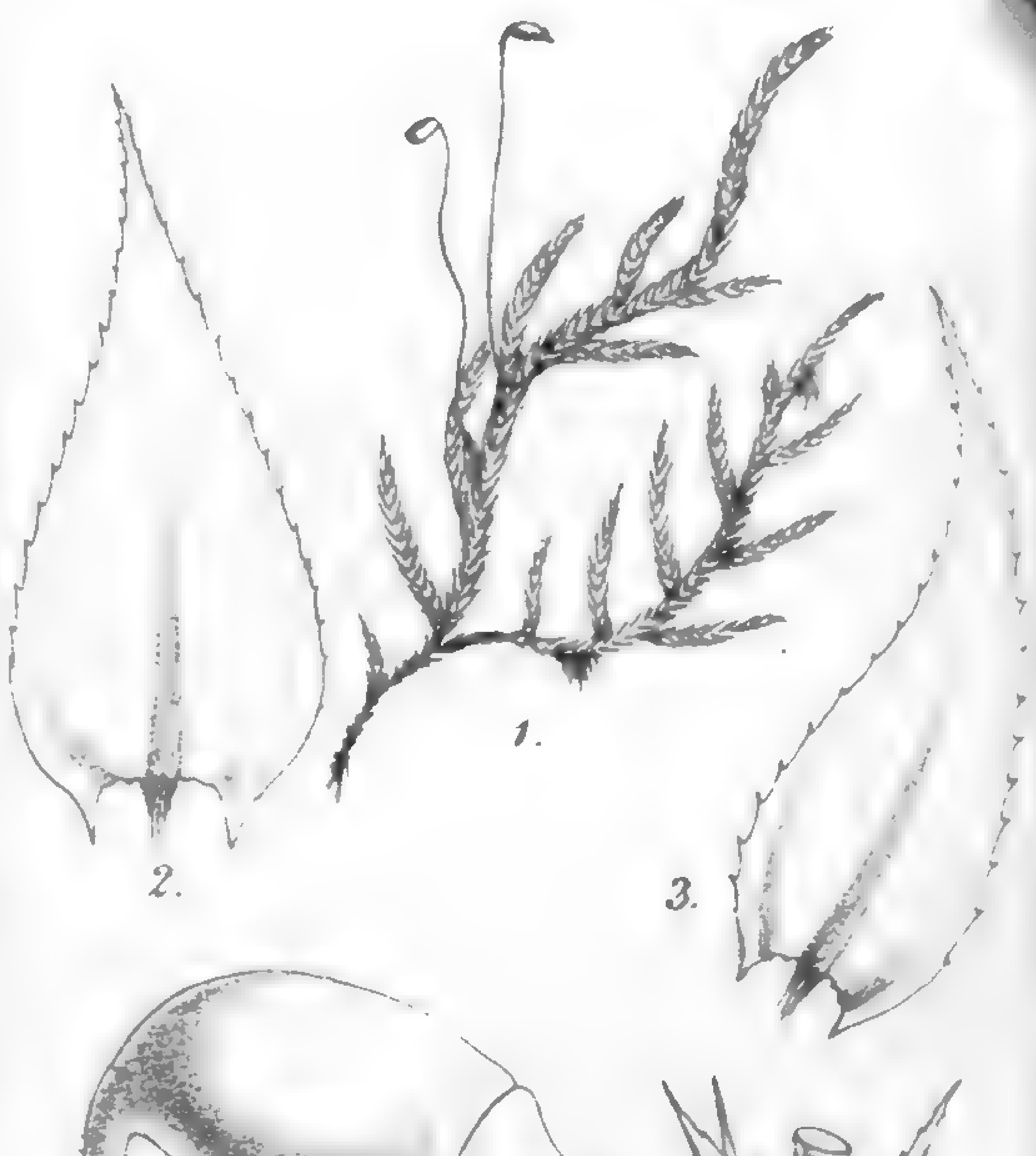


Barbula rubiginosa.



Encalypta longipes.

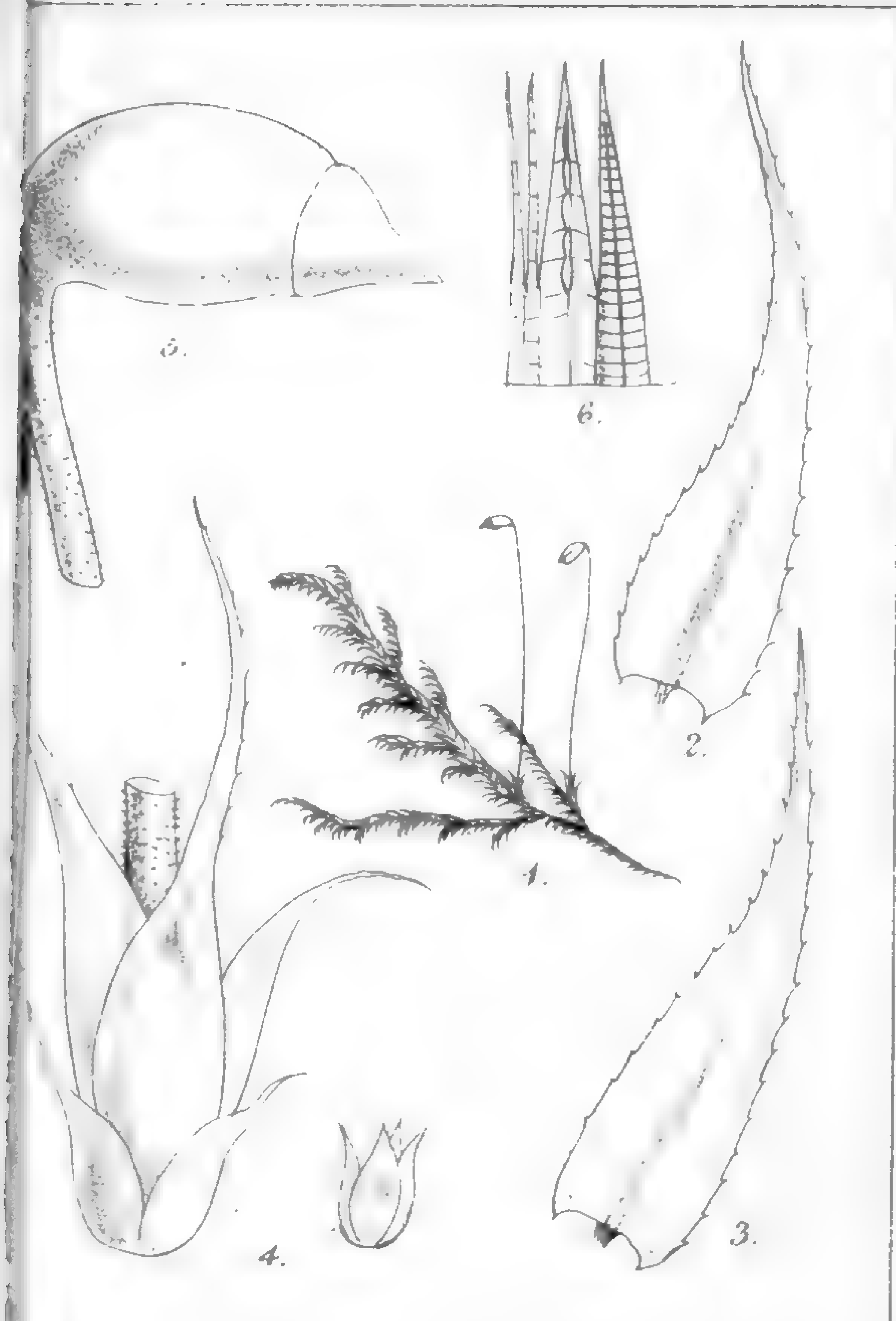
Hypnum æneum.



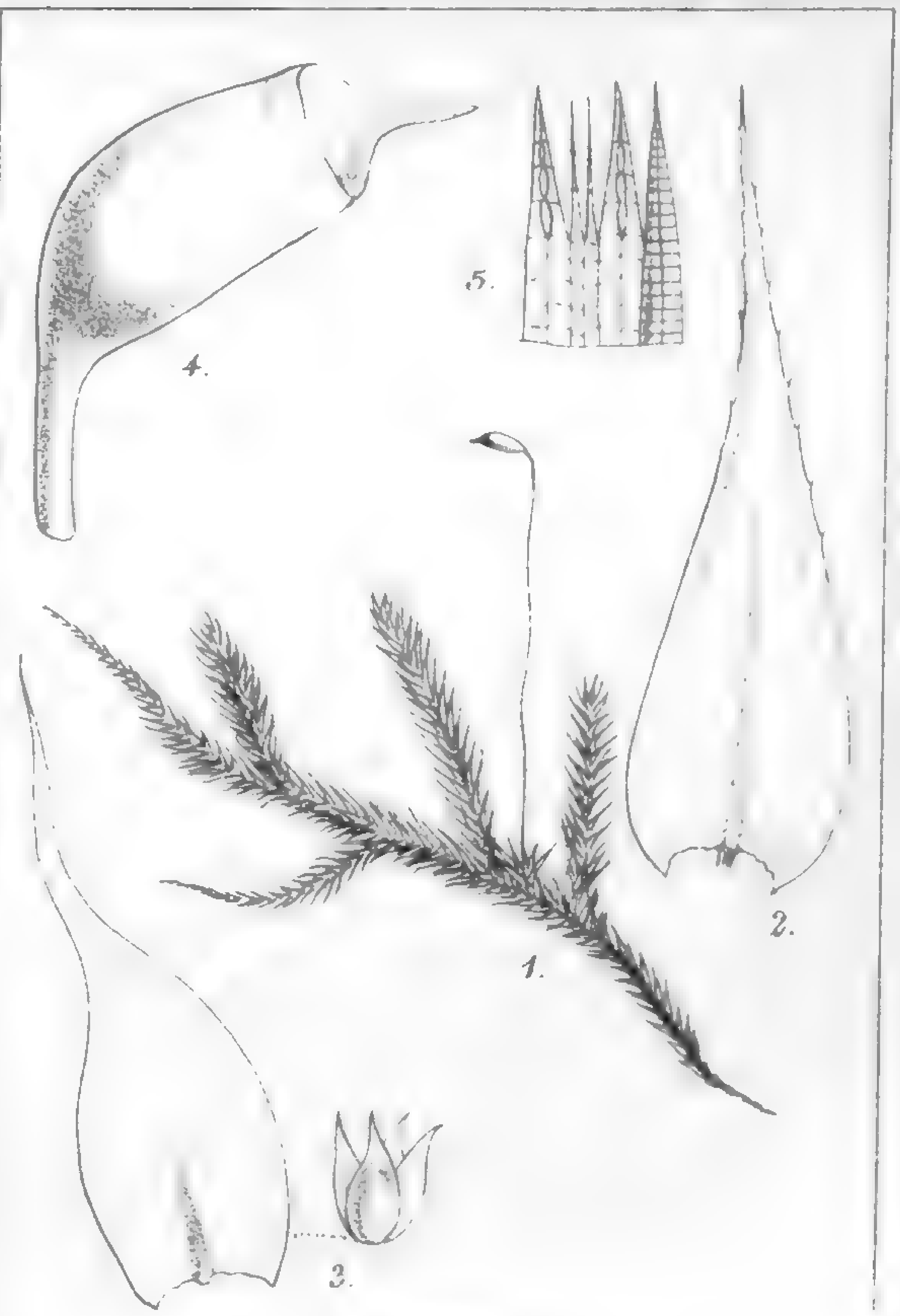
Hypnum œdipodium.

W. Fitch del. et lith.

Vincent Brooks imp.

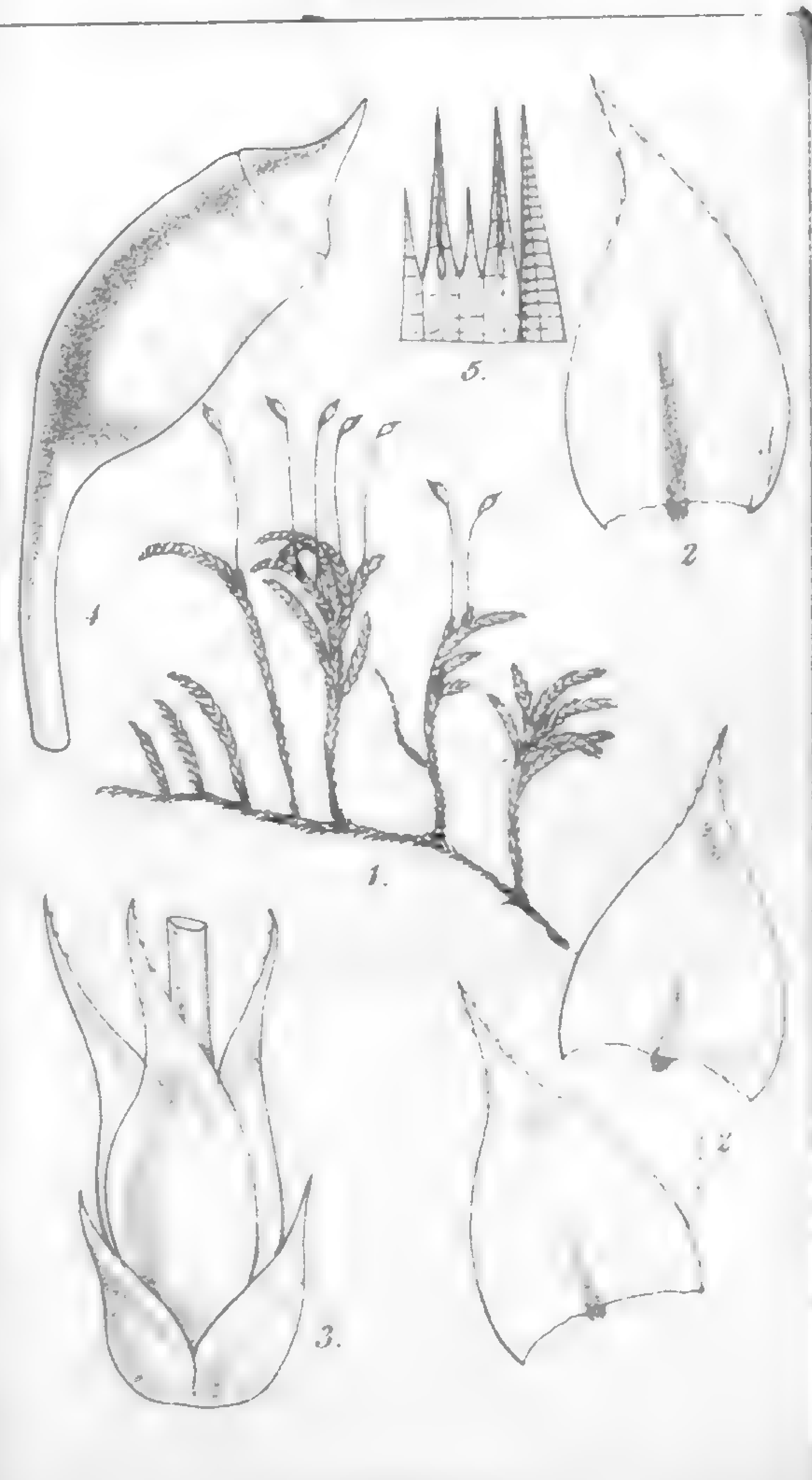


Hypnum declivum.



H. acutum.

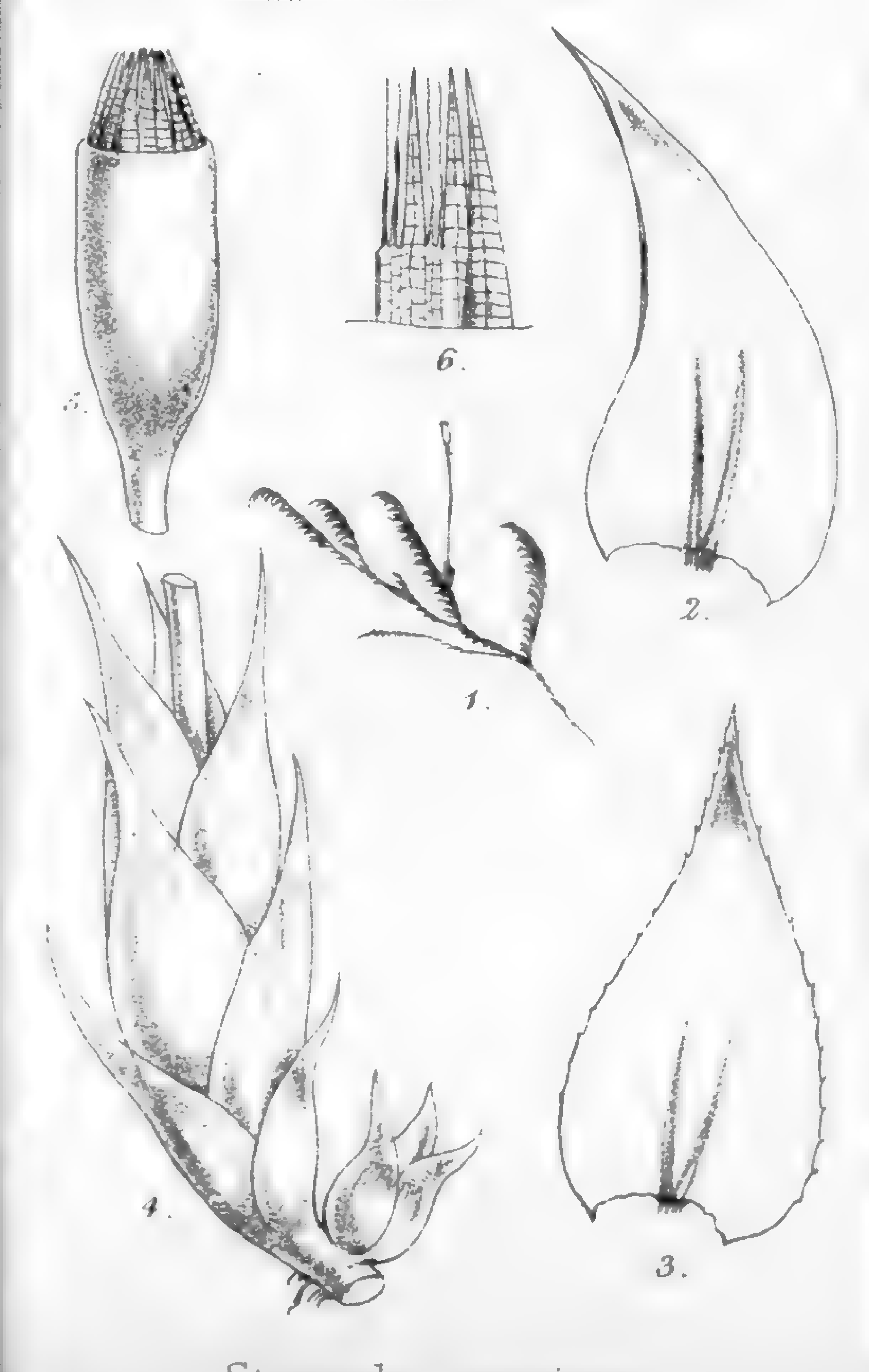
H. asperrimum.



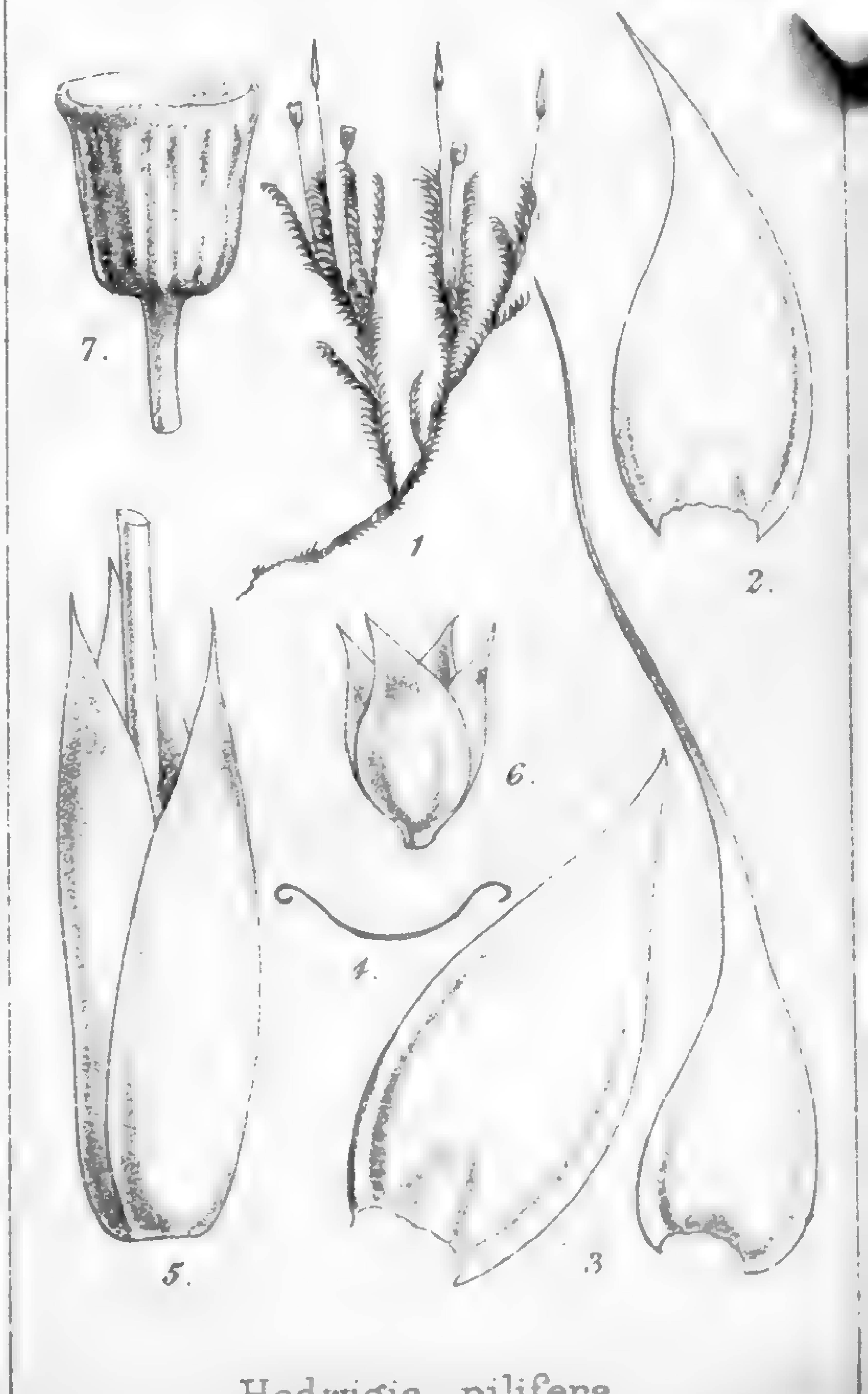
H. aggregatum.

Pterogonium procurrens.

Stereodon plumifer.

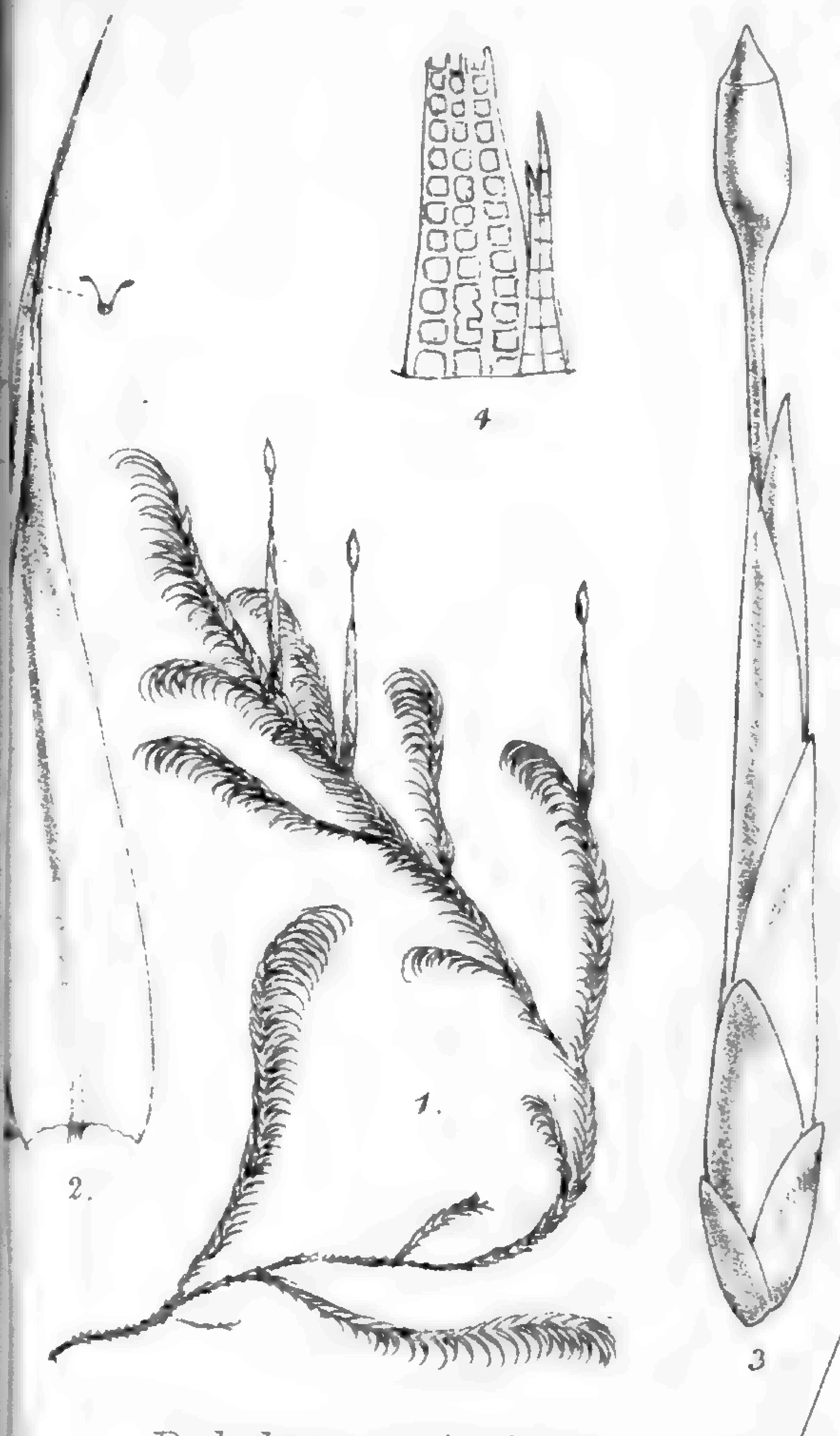


Stereodon geminus.

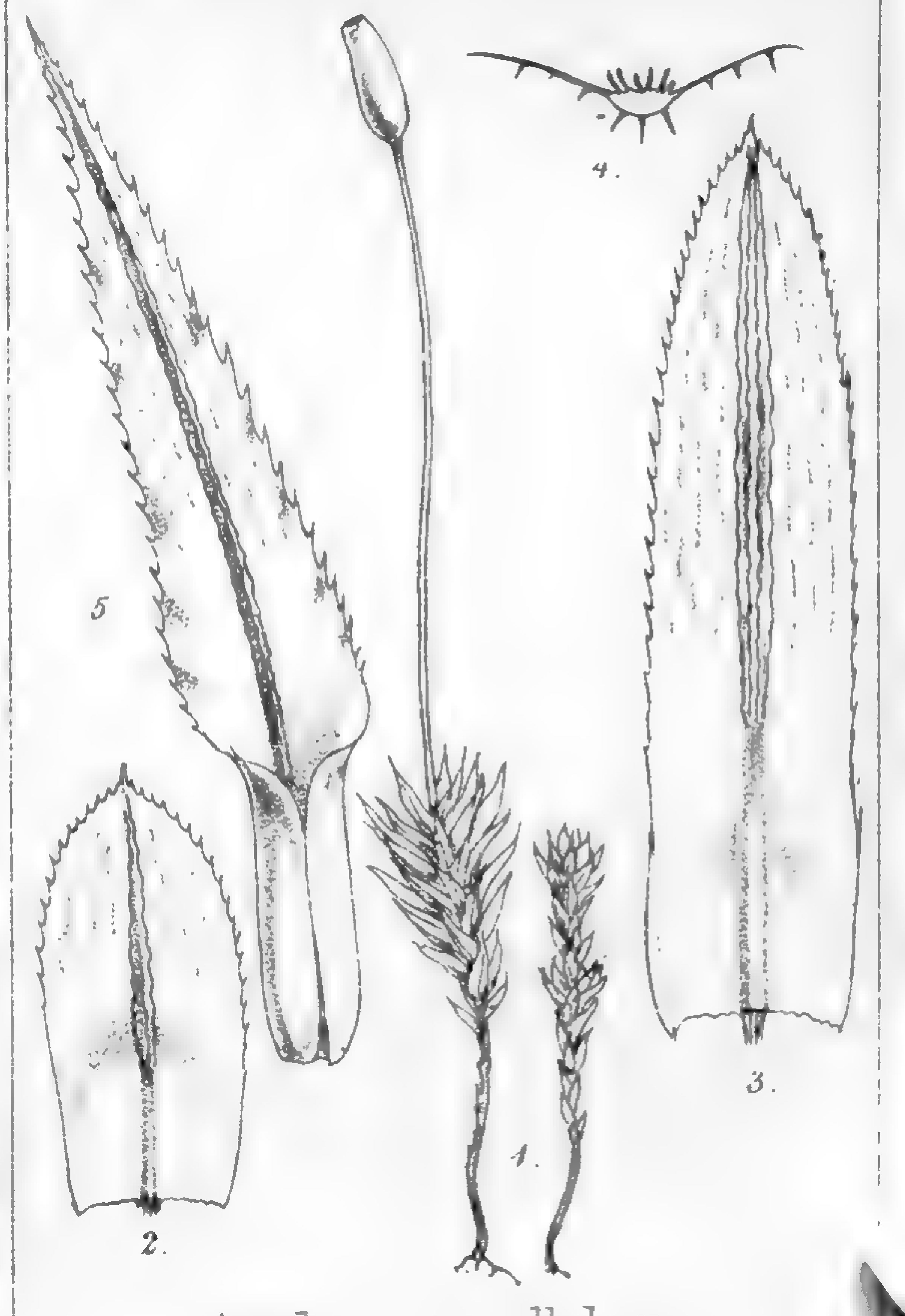


Hedwigia pilifera.

W. Fitch del. et lith.

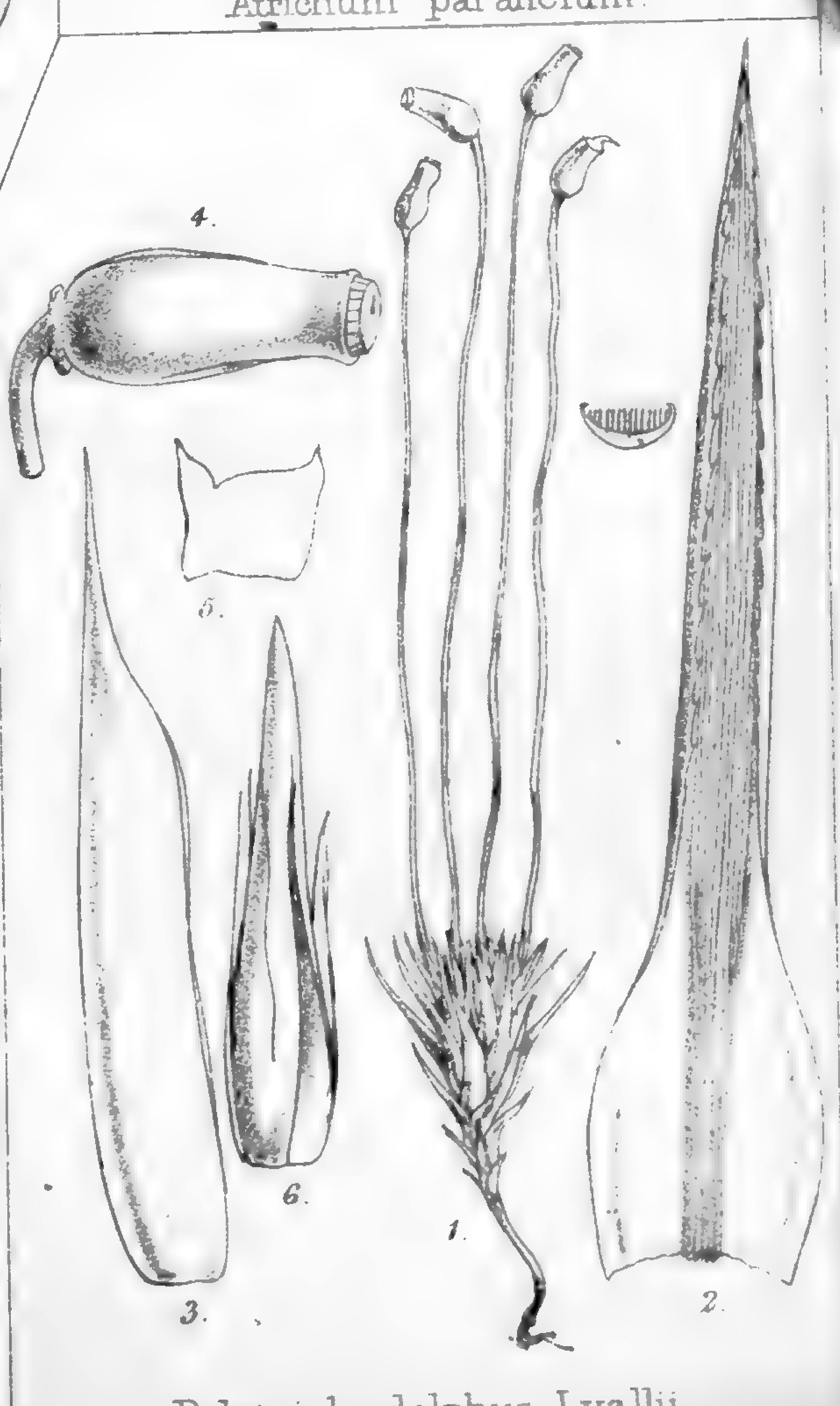


Dichelyma uncinatum.



Atrichum parallelum.

Oligotrichum aligerum.



Polytrichadelphus Lyallii

W. Fitch del et lith.

Vincent Brooks, Imp.

CHIONYPHE CARTERI, BERK.

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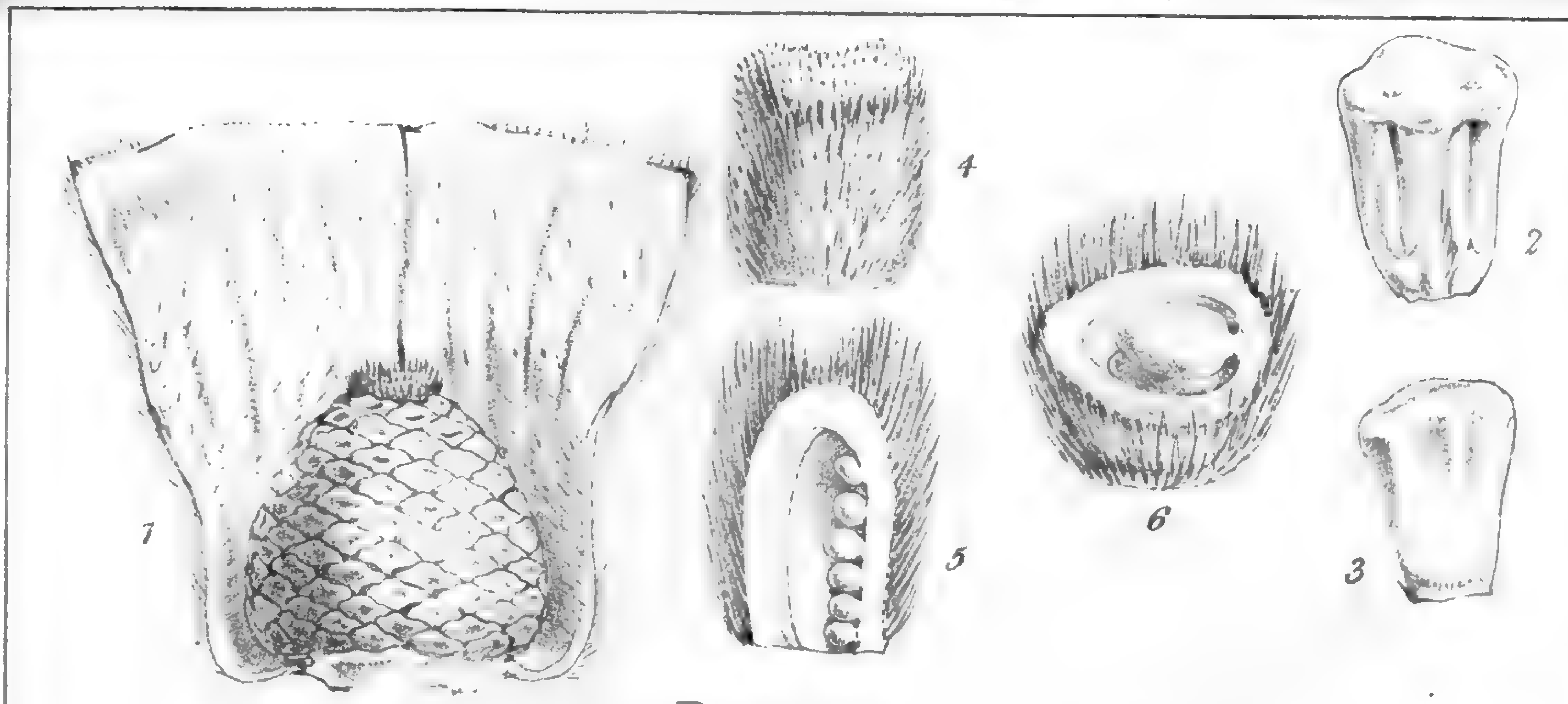
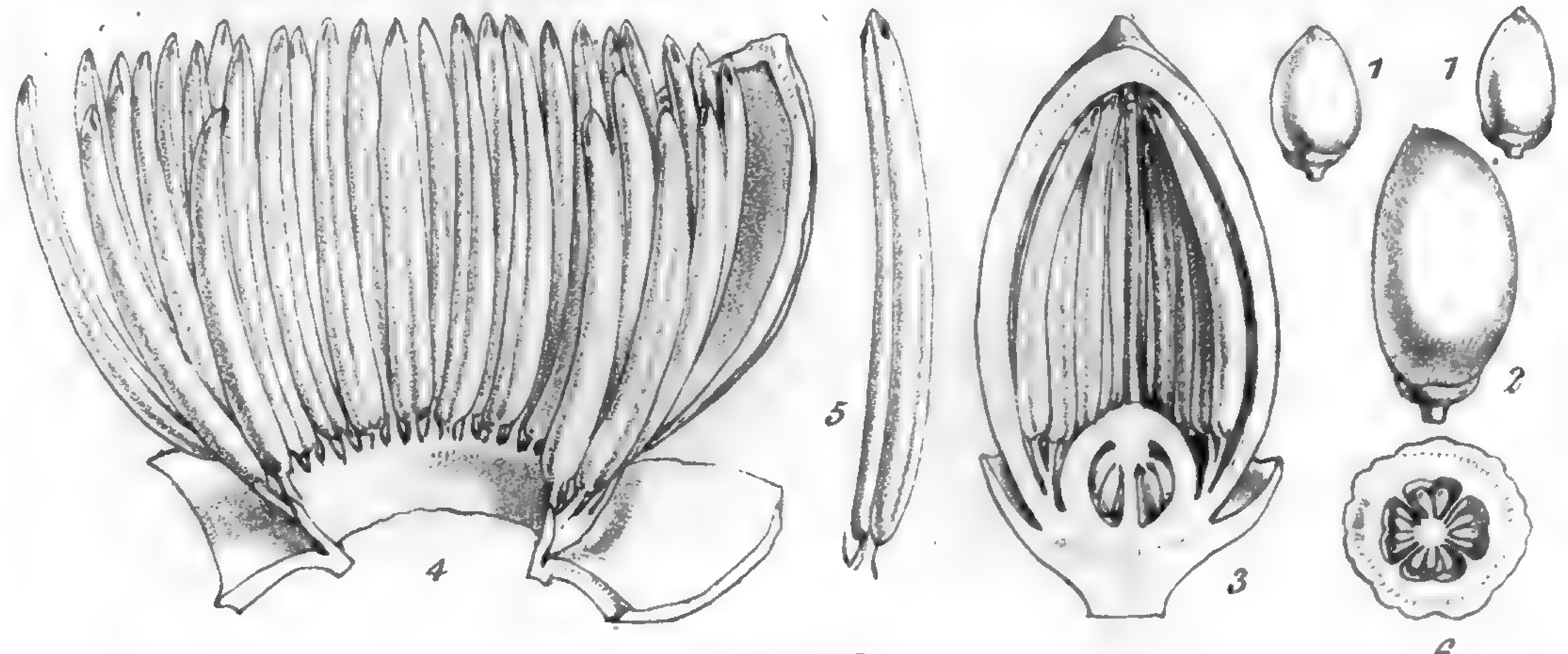
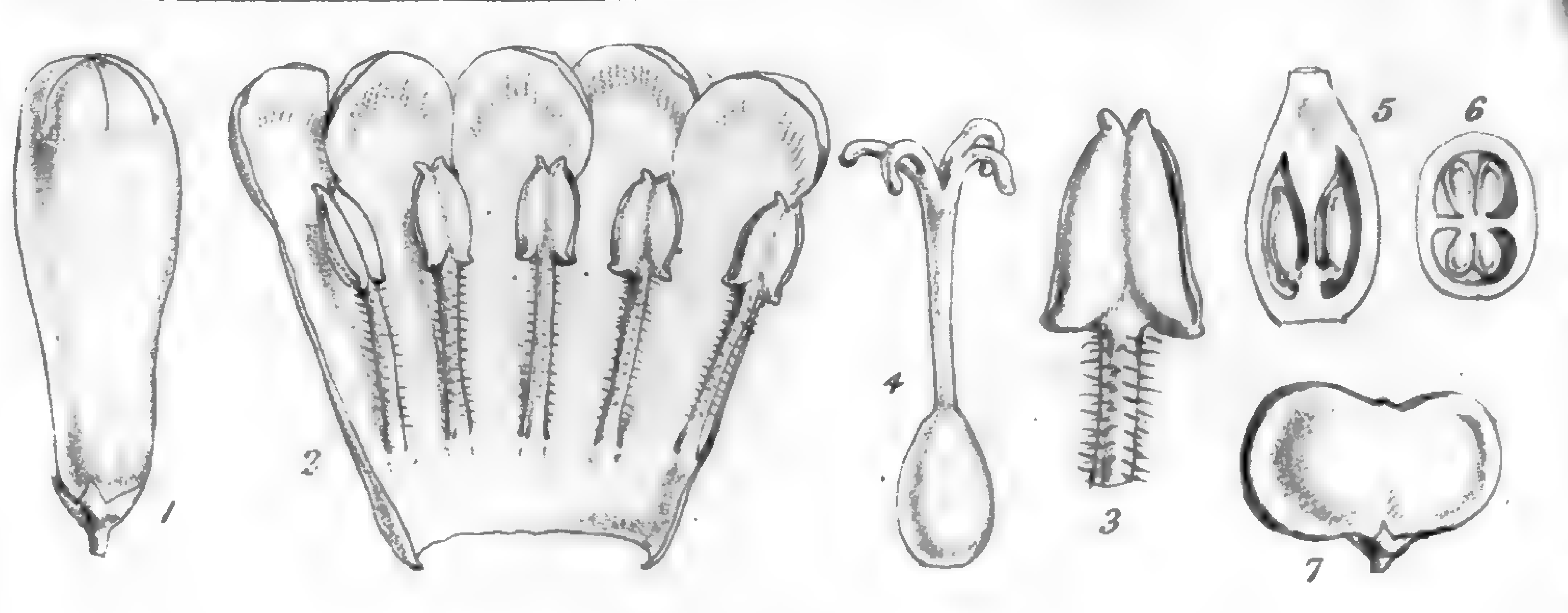


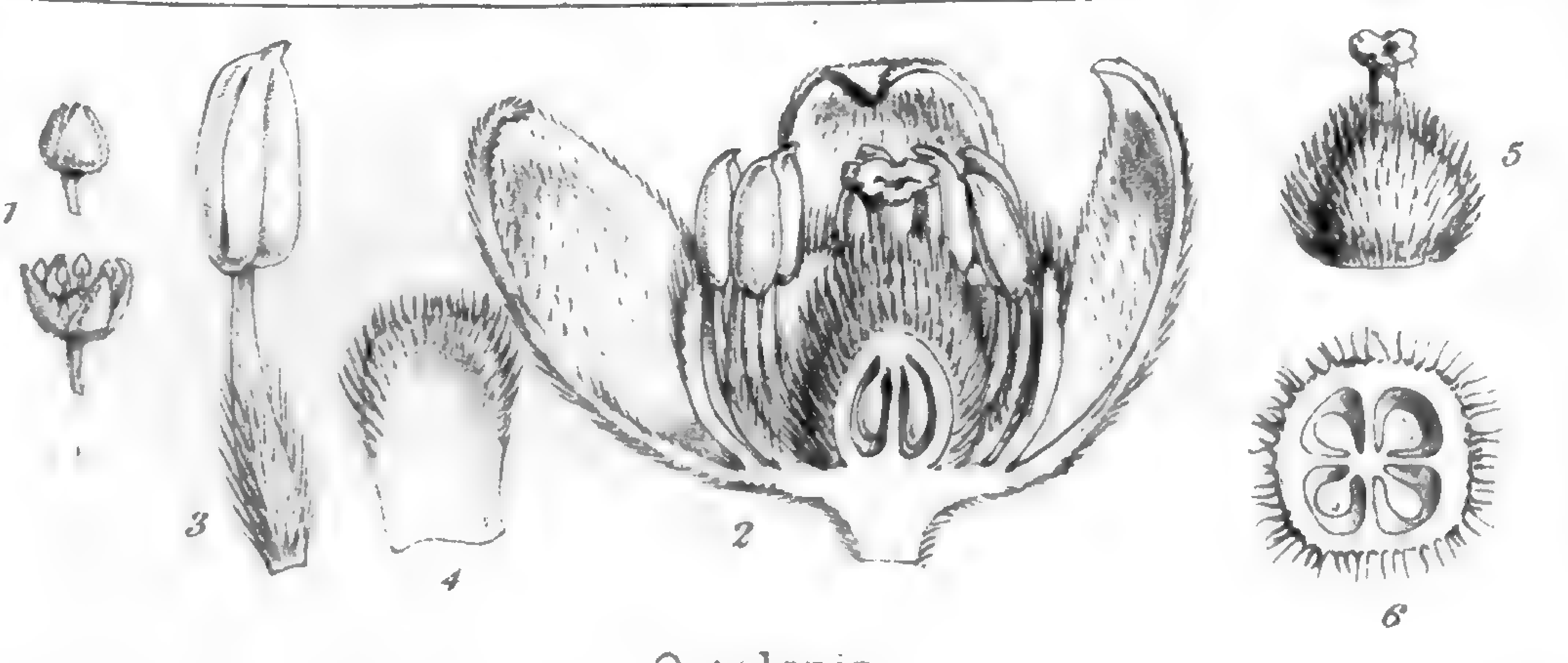
Piptostigma.



Rhaptopetalem



Leptocladus.



Octolepis.

W. Fitch, del et lith

Vincent Brooks, Imp.

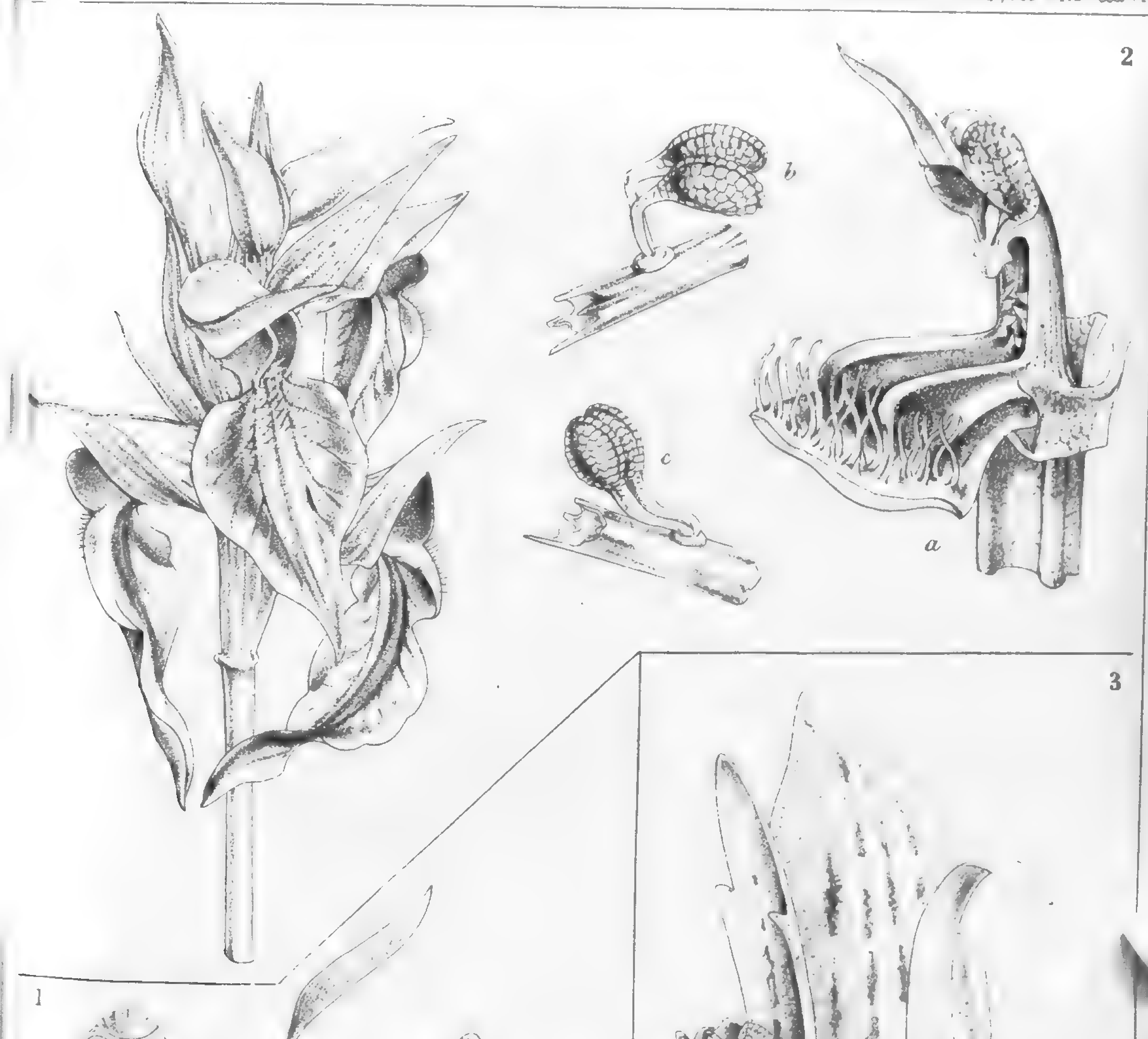
Slœtia Sideroxylon, *T.& B.*

Fig. 1. Fig. 4. Fig. 3. Fig. 2.

M.T.M. ad nat., E.M. Williams, Sc.   Vincent Brooks, Imp.

E. M. Williams, del. ad nat. M. T. M. anal.

Vincent Brooks, Imp.



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JOURNAL

OF

THE PROCEEDINGS

OF

THE LINNEAN SOCIETY.

SUPPLEMENT TO BOTANY.

VOL. I.

CONTAINING

MUSCI INDIÆ ORIENTALIS;

AN ENUMERATION

OF THE

MOSSES OF THE EAST INDIES.

BY

WILLIAM MITTEN, Esq., A.L.S.

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SUPPLEMENT

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JOURNAL OF THE PROCEEDINGS

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LINNEAN SOCIETY OF LONDON.

Musci Indiæ Orientalis; an Enumeration of the Mosses of the East Indies. By WILLIAM MITTEN, Esq., A.L.S.

[Read May 6, 1858.]

In offering the following enumeration of the Indian Musci, it will be necessary that some reasons should be given for the departure from any systematic arrangement hitherto adopted. From the date of Bridel's 'Bryologia' to that of C. Müller's 'Synopsis,' there has been no systematic arrangement of the whole order. Of these, Bridel's arrangement, from the progress of the science and the addition of an immense number of species, cannot now be followed, whilst that of the 'Synopsis' has been departed from in the following particulars:—The Cleistocarpous Order has been suppressed, because its component groups are readily referable to families of higher development: thus, *Sphagnaceæ* have been removed from the side of *Leucobryaceæ*, the leaves of the latter being here understood to be composed entirely or almost entirely of a dilated nerve; *Fissidenteæ* are evidently so closely allied to the distichous *Rhizogonia*, that the place of the group must be with *Mnium*; *Polytrichaceæ* have been removed from the *Mniaceæ* on account of the different structure of their peristome; *Leptotrichaceæ* have been united with *Dicranaceæ*, being destitute of distinctive character; *Pottioideæ* are here called *Trichostomaceæ*, of which the perfect peristome is that of *Barbula*, *Tortula*, or

Syntrichia. The arrangement of the Pleurocarpous Mosses in the 'Synopsis' is rather an agglomeration of species than a systematic disposition: thus, *Neckera* is composed of species whose sole point of affinity lies in the peristome, which, in all the tribe here called *Arthrodonti*, presents but one typical form, of which the highest development is observable in *Bryaceæ*, *Bartramiaceæ*, and in most of the pleurocarpous groups. This peristome consists of an external one of sixteen teeth, each of which is composed of three series of cells, articulated to each other: the two outer of these series are frequently combined into one, but generally having the line of division evident, sometimes separating along this line, as in *Dicranum*, *Fissidens*, *Grimmia*, and many of the *Trichostomaceæ*, of rather firm consistence and generally reddish colour; and the inner series consists of hyaline bladdery cells (to the expansion or contraction of which the hygroscopic action is principally due) reaching across the inner side of the two external series and closely adherent to them. The internal peristome consists of a more or less elongated folded membrane, divided above into processes, often perforated along the carina, with three cilia between each, which at each joint have a small appendage. In all the groups to which this structure appertains, no generic importance is attached to the absence of any part or of the whole peristome: thus, the first modification is the absence of the small appendages to the cilia; next the cilia themselves are reduced in number, shortened, or absent; then the processes decrease in width, the supporting membrane is shortened, and finally the internal peristome is entirely absent. The external peristome presents all stages of development, from the teeth with the internal series of cells highly developed and forming "trabeculæ," to those in which the series is difficult to observe, if present at all; and, as with the internal, the whole external peristome is at times wanting. Many stages of the above transitions are observable in *Bryaceæ* and *Bartramiaceæ*; and as they occur in species which in every other particular possess a very close affinity, it becomes evident that the genera of Mosses cannot be founded on the greater or less development or even absence of an organ which is for the most part reducible to a single typical form, except at the sacrifice of every character plainly observable in other portions of the species. Further, there occur some mosses which produce a peristome or not, according as the theca is more or less developed and elongated: this is seen in *Desmatodon* (as here understood) and in *Encalypta*. The form of the theca, upon which several

genera have been founded by M. Schimper, cannot be trusted to afford a sufficient character: for in *Climacium* and *Cylindrothecium* the species occasionally produce thecæ which are in no way different from the unequal-sided form so general in *Hypnaceæ*; and it appears to be a general law, that the more the theca is inclined or pendulous, the greater is the development of the peristome. The form of the calyptra, whether dimidiate or mitriform, is also, as furnishing a generic character, to be taken with some caution: thus, it serves only to perplex the student to separate *Gumbelia* from *Grimmia*, and *Conomitrium* from *Fissidens*, by such a character, unless it be accompanied by some differences in the other organs of the species. *Meteorium* is here separated from *Trachypus*, the first being understood as a modification of *Hypnum*, the second bearing the same relation to *Leskea*; but *Hedwigia*, *Hedwigidium*, and *Braunia*, though distinguished by scarcely any other character than the calyptra (which passes through forms analogous to those observable in *Grimmia*), are here united and joined with *Leucodontaceæ*, to which they have the closest affinity in the structure of their leaves and mode of growth; for in these days sections cannot be arbitrarily distinguished as acrocarpous or pleurocarpous, when in *Fissidens* the fructification is produced from any part of the stem, and when bryologists have not been able readily to discover to which section *Braunia* should be referred.

The groups, as here understood, are founded upon a difference in the mode of growth, or in the structure of the leaves: this last character has received but little attention from bryologists generally; but by it alone *Bryaceæ* are readily separated from *Mniaceæ*, and *Neckeraceæ* from *Hypnaceæ*, and these from *Leskeaceæ*. The presence or absence of the nerve has been taken advantage of to separate Bridel's *Stereodon* from *Hypnum*, the character serving rather as a ready means of ascertaining the place of a species than as offering any considerable structural difference; yet it will be observed that the species most nearly allied to each other by this division fall together. A separate order of *Hookeriaceæ* has not here been maintained, the sole affinity between its component groups being derived from the calyptra. *Rhacopilum* has been removed from *Hypopterygiaceæ*, with which it has no affinity, and placed in *Leskeaceæ*. The section here called *Nematodonti* presents a peristome whose structure appears to be sufficiently different from that of other mosses,—in *Polytrichiaceæ* the so-called teeth being composed of adglutinated inarticulate filaments.

The materials for the present enumeration have been derived from the collections of Buchanan Hamilton, Gardner, and Wallich, in Nepal; Strachey and Winterbottom, in Kumaon; Royle, in the North-west Himalaya; Perrottet*, Schmid, Foulkes, McIvor, Gardner, and G. Thomson, in the Nilghiri Mountains; Griffith†, in Assam and the Khasia Mountains; Law, in the Concan; Wight, near Madras; Gardner, Thwaites, Walker, and Maxwell, in Ceylon; and Wallich and Parish, in Pegu; but more especially from those made by Dr. Thomson in North-west India and Western Tibet, and by Dr. J. D. Hooker in the Sikkim-Himalaya and East Nepal, and in conjunction with Dr. Thomson in the Khasia Mountains in East Bengal.

Through the great liberality of Sir W. J. Hooker all the original specimens from whence the descriptions and figures in the 'Musci Exotici' and 'Icones Plantarum Rariorum' were derived, have been examined; and, lastly, the entire extensive collections of Dr. Thomson and Dr. J. D. Hooker were entrusted to the author for segregation and distribution. A manuscript catalogue of these has been prepared by Mr. W. Wilson, and is in part published in the last volume of the 'Kew Journal of Botany;' but the determinations are in many cases doubtful, and no descriptions accompany it. I have, however, adopted many of the names applied to the new species, and quoted the MS. in the following enumeration.

Hurst, Sussex, March 1858.

Obs. A mark of admiration (!) is affixed to the names of the collectors whose specimens have been examined; its absence denotes that such specimens have not been seen by the author.

* Dr. Montagne very kindly communicated all the species of interest collected by Perrottet.

† For the correct understanding of many of the species figured and described in Griffith's "Posthumous Papers," I am indebted to N. B. Ward, Esq., who kindly submitted to me all the specimens he received from that author, which were accompanied with descriptions corresponding with those in the 'Notulæ,' published at Calcutta, but which are very little known, if at all, to European bryologists.

CLAVIS ANALYTICA.

S. 1. HOMODICTYA.

* Schistocarpi.

I. Andreæaceæ.

1. Andreæa, *Ehr.*

** Stegocarpi.

† Arthrodonti.

I. Dicranaceæ.

1. Pleuridium, *Brid.*
2. Garckea, *C. Müll.*
3. Leptotrichum, *Hampe.*
4. Trematodon, *Rich.*
5. Leucoloma, *Brid.*
6. Dicranum, *Hedw.*
7. Didymodon, *Hook.*
8. Holomitrium, *Brid.*

II. Leucobryaceæ, *C. Müll.*

1. Leucophanes, *Brid.*
2. Octoblepharum, *Hedw.*
3. Leucobryum, *Hampe.*
4. Schistomitrium, *Dozy & Molk.*

III. Trichostomaceæ.

1. Weissia, *Hedw.*
2. Tortula, *Hedw.*
3. Anœctangium, *Hedw.*
4. Hymenostylium, *Brid.*
5. Barbula, *Hedw.*
6. Desmatodon, *Brid.*
7. Syntrichia, *Brid.*
8. Syrrhopodon, *Hook. & Grev.*
9. Calymperes, *Swartz.*
10. Encalypta, *Schreb.*

IV. Grimmiaceæ.

1. Cinclidotus, *Beauv.*
2. Grimmia, *Ehrh.*
3. Glyphomitrium, *Brid.*

V. Orthotrichaceæ.

1. Drummondia, *Hook.*
2. Zygodon, *Hook. & Tayl.*
3. Orthotrichum, *Hedw.*
4. Ulota, *Brid.*
5. Macromitrium, *Brid.*
6. Schlotheimia, *Brid.*

VI. Funariaceæ.

1. Physeomitrium, *Brid.*
2. Entosthodon, *Schwægr.*
3. Funaria, *Schreb.*

VII. Splachnaceæ.

1. Voitia, *Hornsch.*
2. Tayloria, *Hook.*
3. Splachnum, *L.*

VIII. Bartramiaceæ.

1. Meesia, *Hedw.*
2. Oreas, *Brid.*
3. Bartramia, *Hedw.*
4. Philonotis, *Brid.*
5. Breutelia, *Schimp.*

IX. Bryaceæ.

1. Orthotrichum, *Schwægr.*
2. Mielichoferia, *Hornsch.*
3. Webera, *Hedw.*
4. Bryum, *Dill.*

X. Hypnaceæ.

1. Fabronia, *Raddi.*
2. Hypnum, *Dill.*
3. Meteorium, *Brid.*
4. Trachyloma, *Brid.*
5. Stereodon, *Brid.*
6. Chartomitrium, *Dozy & Molk.*
7. Phyllogonium, *Brid.*
8. Sauloma, *Hook. fil. & Wils.*
9. Lepidopilum, *Brid.*
10. Hookeria, *Smith.*

XI. NECKERACEÆ.

1. Stereophyllum, *Mitt.*
2. Neckera, *Hedw.*

XII. LEUCODONTACEÆ.

1. Hedwigia, *Ehrh.*
2. Leucodon, *Schwægr.*
3. Cryphæa, *Brid.*
4. Cleistostoma, *Brid.*

XIII. LESKEACEÆ.

1. Anomodon, *Hook.*
2. Rhegmatodon, *Brid.*
3. Trachypus, *Schwægr.*
4. Leskea, *Hedw.*
5. Heterocladium, *Schimp.*
6. Callicostella, *C. Müll.*
7. Rhacopilum, *Brid.*

XIV. MNIACEÆ.

1. Fissidens, *Hedw.*
2. Rhizogonium, *Brid.*
3. Mnium, *Dill.*
4. Timmia, *Hedw.*
5. Mniadelphus, *C. Müll.*
6. Daltonia, *Hook.*

XV. HYPOPTERYGIACEÆ.

1. Cyathopterygium, *Brid.*
2. Hypopterygium, *Brid.*

†† NEMATODONTI.

I. BUXBAUMIACEÆ.

1. Diphyscium, *Mohr.*

II. POLYTRICHACEÆ.

1. Atrichum, *Beauv.*
2. Oligotrichum, *Decand.*
3. Pogonatum, *Brid.*
4. Polytrichum, *Dill.*
5. Lyellia, *R. Br.*

S. 2. HETERODICTYA.

I. SPHAGNACEÆ.

1. Sphagnum, *Dill.*

MUSCI.

S. 1. HOMODICTYA. *Foliorum cellulæ ejusdem structuræ.*

* SCHISTOCARPI.

§ 1. ANDREÆACEÆ.

1. ANDREÆA, *Ehrh.*

1. A. RIGIDA (*Wils. in Kew Journ. Bot.* ix. p. 289). Caulibus elongatis, foliis falcatis secundis e basi late ovali brevi longe subulato-attenuatis, nervo crasso subulam superiorem totam occupante, cellulis parvis areolatis, margine integerrimis inferne planiusculis.

Hab. In Himalayæ orient. reg. alp., Sikkim, *J. D. Hooker*! (No. 1).

A. falcata (Schimp.) similis, foliis autem e basi ovata nervo excurrente longe subulatis.

2. A. petrophila, *Ehrh.* (A. petrophila et A. ambigua, *Wils. l. c.* p. 289.)

Hab. In Himalayæ orient. reg. temp. et alp., Sikkim, *J. D. Hooker*! (No. 2, 3, 5, 6 *d*).

3. A. INDICA (*Mitten*). *A. petrophilæ* simillima, sed robustior, foliis ambitu ovatis acuminatis e basi subquadrata erecta cauli adpressa

cellulis oblongis parallelogrammaticis parietibus tenuibus areolata patentibus concavis dorso papillosis, cellulis parvis parietibus crassis, perichætialibus ovatis convolutis.

Hab. In Himalayæ orient. reg. alp., Sikkim, *J. D. H.*! (No. 4, 6 *a*).

A. petrophilæ colore habitu perichætioque similis, structura tamen folii baseos valde diversa statim dignoscenda.

4. A. DENSIFOLIA (*Mitten*). Habitus *A. petrophilæ*, foliis ovato-lanceolatis concavis obtusiusculis dorso papillosis, cellulis elongatis superioribus obscuris inferioribus longioribus iis *A. petrophilæ* similibus, perichætialibus elongato-ovalibus acutis convolutis, theca parva ad $\frac{1}{4}$ longitudinis dehiscente.—*Acroschisma densifolia*, Wils. l. c. p. 289.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. H.*! (No. 6 *b*).

A. petrophilæ similis, folia autem paululum angustiora siccitate appressa stricta. *Theca* parva.

** STEGOCARPI.

† ARTHRODONTI

Peristomium dentibus e triplici serie cellularum inter se adglutinatarum conditis; seriebus externis duabus coloratis sæpe rubris, in unam sæpe coalitis; serie unica interna latiore teneriore, hyalina, maxime hygroscopica, trabeculas formante.

§ 1. DICRANACEÆ.

Archidiaceæ, Bruchiaceæ, Pleuridiaceæ, Trichostomaceæ (ex parte), Weissiaceæ ex parte, Zygodonteæ ex parte, Seligeriaceæ ex parte, et Dicranaceæ, *Schimp. Coroll.*

1. PLEURIDIUM, *Brid.*

1. P. denticulatum, *Mitten.* (Astomum denticulatum, *C. Müller, Bot. Zeit.* 1853, p. 18.)

Hab. In Mont. Nilghiri, *Schmid.* E descriptione *P. nervoso* simillimum.

2. P. TENUE (*Mitten*). Dioicum? caule erecto simplici gracillimo, foliis patentibus lanceolatis concavis marginibus integerrimis, nervo lato tenui folii partem superiorem totam occupante, cellulis basi tantum a nervo distinctis elongatis teneris, perichætialibus caulinis conformibus, theca in pedunculo elongato erecta ovali-cylindrica in rostrum rectum obtusum sensim acuminata.—*Phascum tenue*, Wils. l. c. p. 290.

Hab. In Himalayæ orientalis regione alpina, Sikkim, *J. D. H.*! (No. 30). Inter cæspitulos *Weberæ polymorphæ* specimina perpauca carpsi.

Caulis vix lineam longitudine superans, gracillimus. *Pedunculi* bilineares.—A *P. alternifolio* et speciebus affinibus statura multo graciliore et pedunculo elongato recedit, structura foliorum autem omnino convenit. Species singularis positionem eandem respectu *Leptotrichi* ut *Phascum bryoides* respectu *Pottiæ* tenens.

Obs. Phascum nepalense (Brid. i. p. 755) speciem obscuram non enumeravi.

2. GARCKEA, *C. Müller, Synops.* i. p. 424.

1. G. phascoides, *C. Müller, l. c.*; *Dozy et Molkenb., Musci Frond. inediti Archipel. Ind.* t. lix. (Dicranum phascoides, *Hook. Bot. Miscell.* 1830, t. 30. Grimmia flexuosa, *Griff. Notulæ*, p. 412; *Icon. Plant. Asiat.* ii. pl. lxxix. f. 3.)

Hab. India tropica; Nepal, *Wallich*! "Sylhet, Maamloo collium Khasyanorum, Deboro prope Rangagurrah, *Griffith*! Moulmein, *Parish*!

3. LEPTOTRICHUM, *Hampe.*

Didymodon ex parte, *Hedw.*; Trichostomum ex parte, *B. & S. Bryol. Europ.*; Dicranella et Trichodon, *Schimper, Corol.*; Angstrœmia, *C. Müller, Synops.*; Gyrophyllum, *Dozy et Molk.*; Symblepharis, *Mont.*

Peristomii structura *Dicrani*, cui folia etiam arcte conveniunt, vix nisi defectu cellularum alarium et statura graciliore plantularum discrepans.

* *Pedunculus flexuosus.*

1. L. phascoides. (Angstrœmia phascoides, *C. Müller, Bot. Zeit.* 1853, p. 39.)

Hab. In Mont. Nilghiri, *Schmid.*

2. L. KHASIANUM (*Mitten*). Dioicum? "caule simplici brevi, foliis falcatim subsecundis e basi lata longissime subulato-acuminatis acuminibus infra medium obsolete canaliculatis, vena crassiuscula, seta flexuosa, capsula inclinata cernuave ovato-elliptica siccatione sulcata, operculo conico-subulato, calyptra ventricosa lævi." *Griff.*

Dicranum khasianum, *Griff. Not.* p. 418; *Icon. Pl. Asiat.* ii. pl. xciv. f. 2.—Campylopus tenuis, *Wils. in Sched. l. c.* p. 296.

Hab. In Mont. Khasianis, ad Moflong, *Griff.*! et in regione subtropica, *J. D. H.* et *T. T.*! (No. 97). In Himalayæ orient. reg. temp., Sikkim, *J. D. H.*! (No. 95). In insula Ceylon, *Thwaites*!

L. euphorocladæ (*Angstrœmia*, C. Müller) simillimum, sed theca, apophysi nulla, minus plicata, et cellulis folii partis inferioris laxioribus latioribusque, nervo angustiore, peristomio teneriore. Caulis in speciminibus peninsularibus bi- tri-linearis, in Ceylanicis uncialis.

** *Pedunculus erectus.*

3. L. POMIFORME (*Mitten*). Dioicum, humile, gracile, caule erecto simplici, foliis laxis patentibus lanceolatis nervo tenui sub summo apice evanido cellulis teneris ubique pellucidis, perichætialibus latioribus cæteroquin caulinis similibus, theca in pedunculo tortili stramineo globoso-ovata æquali aurantiaca, operculo subulato obliquo longitudine capsulam superante, peristomio dentibus brevibus inæqualibus annulo duplici.

Didymodon pomiforme, *Griff. Not.* p. 431; *Icon. Plant. Asiat.* ii. pl. lxxx. f. 3.—Angstrœmia exigua, *C. Müller, Wils. l. c.* p. 296.

Hab. "Rupes ripæque Maamloo collium Khasyanorum," *Griffith*! In Himalayæ orient. reg. temp. ad Darjeeling, in ripis argillosis, *J. D. H.*! (No. 40).

Caulis bi- quadri-linearis, altitudine variabilis.—*L. exiguo* (Angstrœmia, *C. Müller*) habitu magnitudineque affine, foliis autem laxioribus patentibus varie flexis, e cellulis latioribus laxis pellucidis areolatis, satis diversum.

4. L. tortile, *Hampe*.

Hab. In Nepal, *Wallich*! In Himalayæ orient. reg. temp. et alp., Sikkim, *J. D. H.*! (No. 21, 24, 25, 41).

5. L. DIVARICATUM. Dioicum, caule simplici, foliis e basi subquadrata erecta subulatis divaricatis flexuosis incurvisque integerrimis nervo in apicem evanido, cellulis elongatis firmiusculis, perichætialibus basi magis dilatatis cæteroquin conformibus, theca in pedunculo stricto ovali suberecta siccitate paululum plicata, operculo subulato obliquo, peristomio e dentibus rubris dicranis, annulo duplici.

Dicranum subulatum, *Griff. Not.* p. 417.—D. cerviculatum, *Wils. l. c.* p. 296.

Hab. In montibus Khasianis Bengaliæ orientalis. "Ripæ circa Moflong," *Griffith*! et Churra regione tropica, *J. D. H.* et *T. T.*! (No. 83).

L. subulato et *cerviculato* (Angstrœmia, *C. Müller*) comparandum. *Color* fusco-luteus. Caulis subuncialis, foliis remotiusculis rigidulis. A *L. subulato* foliis divaricatis, perichætialibus basi brevibus, statim dignoscitur. A *L. cerviculato* structura foliorum, nervo angustiore apice tantum a foliorum parte subulata indistincta, satis diversum videtur.

6. L. GRIFFITHII (*Mitten*). Dioicum, caule simplici, foliis e basi subquadrata erecta subulatis patentibus integerrimis canaliculatis, nervo subulam superiorem totam occupante, cellulis basi laxis pellucidis, perichætialibus basi latioribus, theca in pedunculo gracili breviusculo tortili recto ovato-cylindrica erecta siccitate plicata, peristomio dentibus solidis dicranisve, annulo duplici.

Dicranum khasianum, *Griff. Not.* p. 418. var. A. majus.

Hab. In mont. Khasia. "Rupes madidæ ad Churra et Moflong," *Griffith*!

Habitus *L. khasyani*, sed caulis gracilior trilinearis—sesquiuncialis. Folia basi laxius areolata; pedunculus trilinearis gracilior rectus tortilis; theca magis cylindrica. A *L. divaricato* statura graciliore, foliis patentibus basi cellulis majoribus, nervo in parte subulato minus distincto et peristomio pallidiore ochraceo differt.

7. L. AMPLEXANS (*Mitten*). Monoicum, caule subsimplici, foliis e basi subquadrata superne dilatata erecta late vaginanti subulatis patentibus incurvis, siccitate crispulis, integerrimis, apice tantum minute parce denticulatis, nervo ubique distincto, cellulis basi elongatis teneris pellucidis superne brevibus viridibus, perichætialibus conformibus.

theca in pedunculo recto elongato ovali inclinata symmetrica lævi, peristomii dentibus breviusculis rubris solidis geminatis.

Hab. In Nepal, *Wallich*!

L. divaricato habitu staturaque similis, differt tamen foliis basi latius vaginantibus, nervo in folio nullibi dilatato et florescentia. In caule unico fructifero ramulos breves foliis sacculatis, omnino ut in speciebus congeneribus monoicis, quamvis antheridias includentibus, non certe observavi. Peristomium in exemplo uno perfecto e dentibus geminatim coalitis.

8. L. TORTIPES (*Mitten*). Monoicum, caule subsimplici, foliis patentibus e basi elliptica cellulis amplis pellucidis areolata subulatis integerrimis apiceve subdenticulatis nervo latiusculo subulam totam occupante canaliculatis, perichætialibus longiusculis vaginantibus laxe areolatis, theca in pedunculo gracili fusco recto tortili ovato-cylindrica, peristomio dentibus solidis dicranisve teneris aurantiacis, flore masculo in ramulo brevi terminali.

Trichostomum delicatulum ex parte, *Wils. l. c.* p. 321.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. H.*! (No. 8).

Formis nonnullis parvulis *T. homomalli* simile, sed folia basi ovalia ellipticave cellulis latiusculis laxis areolata.

9. L. plicatum, *C. Müller, Synops.* i. p. 446.

Hab. In mont. Nilghiri, *Perrottet*!

10. L. LAXISSIMUM (*Mitten*). Monoicum, tenellum, gracillimum, caule breviusculo subsimplici, foliis patentibus e basi elliptica laxissime areolata longissime tenuissime subulato-attenuatis, nervo subulam totam occupante a medio ad apicem minute denticulatis, perichætialibus basi latioribus vaginantibus, theca in pedunculo gracili luteo tortili subcylindrica tenera, operculo rostro longe subulato capsulam subæquante, peristomii dentibus dicranis pallidis cruribus gracilibus elongatis, flore masculo satis magno in ramulo brevi quasi pedicellato, foliis perigonialibus brevibus ovatis.

Trichostomum delicatulum ex parte, *Wils. l. c.* p. 321.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. H.*! (No. 7 et 9).

Color plantularum luteo-fuscus. *L. plicato* quocum statura convenit primo adspectu simile, sed folio basi latiore multo laxius areolato statim dignoscendum.

11. L. capillaceum. (Distichium, *Bryol. Europ.* fasc. xxx.—Didymodon cirrhifolius, *Harvey, Hook. Icon. Plant. Rar.* t. 18.)

Hab. In Himalayæ reg. alp. et temp., Nepal, *Wallich*! Sikkim, *J. D. Hooker*! (No. 20, 34, 38, 39, 99); in Tibetiæ occident. reg. temp. et alp., *T. Thomson*! (No. 32, 33, 35, 36, 37, 37 *b*); *H. Strachey* (No. 274).

12. L. inclinatum, *Mitten*. (Distichium, *Bryol. Europ.* fasc. xxx.)

Hab. In Himalayæ orient. reg. alp., Sikkim, *J. D. H.* (No. 22 *b*); in

Tibetiæ occident. reg. alp., *T. Thomson* (No. 275), et ad Raj Hoti, *Strachey et Winterbottom.*

13. L. SETIFERUM (*Mitten*). Dioicum, caule simplici erecto, foliis e basi erecta quadrata vaginante superne parce crenulatis subito longiuscule setaceo-attenuatis integerrimis undique patentibus flexuosis, nervo canaliculato partem subulatam totam fere occupante, cellulis basi elongatis firmiusculis flavo irroratis, perichætialibus basi parum longioribus, theca in pedunculo elongato gracili recto luteo seniore fusco inclinata ovali aurantiaca basi strumosa siccitate plicata, ore obliquo, operculo longe subulato, peristomio dentibus dicranis rubris.
Species a *Cl. Wils.* cum concrescentibus commutata, *l. c.* p. 295.
Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 94 *b*).
Primo adspectu formis majoribus *L. heteromalli* (Angstrœmia, *C. Müller*) non dissimile, sed foliis rigidioribus e basi erecta vaginante satis diversum. A *L. divaricato,* cui proxime accedit, foliis patentibus tenuiter setaceis, et, ubi pars erecta cauli adpressa in subulam evadit, crenulatis, nervo latiore et theca inæquali strumosa, certe distat.

14. L. heteromallum. (Angstrœmia, *C. Müller, Syn.* i. p. 432.)
Hab. In Himalayæ orient. reg. temp. et. alp., Sikkim, *J. D. Hooker*! (No. 10, 12, 13, 14, 15, 15*b*, 16).

15. L. Schmidii, *C. Müller, Bot. Zeit.* 1853, p. 39.
Hab. In mont. Nilghiri, *Schmid.*

16. L. MOLLICULUM (*Mitten*). Dioicum, caule brevi simplici, foliis patentibus ovatis elongatis obtusis acutatisve concavis nervo tenui sub apicem evanido margine superne serratis, cellulis inferne elongatis superne brevioribus sub-obscuris flaccidis, perichætialibus e basi erecta superne dilatata vaginante subulatis squarrosis apicibus obtusis; theca in pedunculo breviusculo luteo ovali sub-erecta basi substrumosa, operculo subulato curvirostrato, peristomio dentibus rubris dicranis.
Dicranum patulum ex parte, *Wils. l. c.* p. 295.
Hab. In Himalayæ boreali-occident. reg. temp., *T. Thomson* (No. 98).
Statura *L. Miqueliani* (Weissia, *Mont.*), sed foliis flaccidis, nervo tenuiore et cellulis multo laxioribus.

17. L. patulum, *Mitten.* (*L. squarroso* persimile, sed foliis margine minute denticulatis.—Dicranum patulum ex parte, *Wils. l. c.* p. 296.)
Hab. In Himalayæ orient. reg. temp., Sikkim, inter cæspites Bartramiæ, *J. D. Hooker*! (No. 94).
A *L. molliculo* forma et directione foliorum acutorum diversum; a *L. squarroso,* quocum statura, habitu coloreque convenit, marginibus foliorum denticulatis distinguitur.

18. L. virens, *Mitten.* (Angstrœmia, *C. Müller.*—Dicranum strumiferum, *Wils. l. c.* p. 295.)
Hab. In Tibetiæ occident. reg. temp., *T. Thomson* (No. 55).

19. L. himalayanum, *Mitten*. (Didymodon vaginatus, *Hook. Lond. Journ. Bot.* 1840, ii. p. 5; *Icon. Plant. Rar.* t. 18.—Symblepharis Hookeri, *Wils. l. c.* p. 292.—S. dilatata, *Wils., l. c.* p. 293.)
Hab. In Himalaya temperata; Nipal, *Wallich*! et *J. D. Hooker* (No. 108, 108*b*, 109); Sikkim, *J. D. Hooker* (109*b*, 109*c*, 110, 110*b*, 111, 111*b*, 112, 113, 113*b*, 125*b*, 150). In Kumaon. reg. temp., *Strachey et Winterbottom, et T. Thomson* (No. 125).

20. L. Reinwardti, *Mitten*. (Angstrœmia, *C. Müller*, *Syn.* i. p. 437.—Gyrophyllum Reinwardti, *Dozy et Molk. Musc. Frond. Archip. Ind.* t. xlv.—Symblepharis dilatata ex parte, et S. breviseta, *Wils. l. c.* p. 293.)
Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 136, 136*b*).
Habitus omnino precedentis, quocum structura adeo convenit ut nulla methodo naturali separari potest. Peristomium dentibus æquidistantibus dicranis ab eo *L. Himalayani* et specierum aliarum *Symblephari* generi adscriptarum diversum, sed differentia hæcce momenti ejusdem ut in speciebus *Orthotrichi* generis censenda est.

21. L. Wahlenbergii, *Mitten*. (Angstrœmia, *C. Müller*, *Syn.* ii. p. 610.)
Hab. In Himalayæ orient. reg. temp. et alp., Sikkim, *J. D. Hooker*! (No. 112*b*, 151, 151*b*).

4. Trematodon, *Rich.*

1. T. longicollis, *Rich.*
Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 48, 49). In Ceylon, *Gardner* (No. 45). In Assam regione superiore thecis maturis Aprili—Maio, *Griffith*!.

2. T. conformis (*Mitten*). Monoicus, caule brevi simplici dichotomove, foliis erectis patulis flexuosisve mollibus, caulinis inferioribus lanceolatis superne remote serratis nervo sub apice obtuso evanido carinatis margine subrecurvo, superioribus perichætialibusque basi latioribus sensim angustatis elongatis, omnibus cellulis inferne elongatis superne oblongis pellucidis teneris, theca in pedunculo elongato stramineo ovali cylindrica curvata siccitate plicata, collo basi substrumoso capsula duplo longiore, operculo subulato longi-curvirostrato, peristomio dentibus rubris lanceolatis perforatis annulo triplici, flore masculo laterali, foliis perigonialibus caulinis conformibus.
Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. H.*! (No. 47). In Nepal, *Wallich*!.
T. longicolli simillimus, sed foliis laxius areolatis, caulinis superioribus et perichætialibus conformibus, nunquam, ut in *T. longicolli*, a basi vaginante dilatata subulatis.

3. T. Schmidii, *C. Müller*, *Bot. Zeit.* 1853, p. 40.
Hab. In mont. Nilghiri, *Schmid*.

4. T. paucifolius, *C. Müller, Syn.* i. p. 459.
Hab. In mont. Nilghiri, *Schmid.*

5. T. sabulosus, *Griff. Not.* p. 413; *Icon. Plant. Asiat.* pl. lxxxii. f. 1.
Hab. "Ad ripas arenosas fluminis Burrumpootur tractumque sabulosum huic vicinum" et in Assam editioribus humidis frequentissime, *Griffith*! In Bootan, *Booth*!.
A speciebus aliis indicis, foliis brevibus statim distinguitur. A descriptione *T. paucifolii* foliis margine recurvis varie flexis contortisque discrepat, neque cum *T. ambiguo* comparandus.

6. T. DECIPIENS (*Mitten*). Monoicus, caule erecto ramoso, foliis flaccidis patentibus lanceolatis obtusis planiusculis nervo tenui sub apice denticulato evanido, perichætialibus basi parum latioribus, omnibus cellulis laxissimis elongatis pellucidis, theca in pedunculo gracili luteo inclinata cylindracea lævi, collo brevissimo, operculo subulato, peristomii dentibus cruribus longis ad basin discretis teretiusculis, annulo composito, flore masculo in ramulo terminali foliis intimis brevibus coloratis.
Trichostomum? pellucidum, *Wils. l. c.* p. 321.
Hab. In insula Ceylon, *Gardner*! (No. 44); *in Herb. Peradeniensi* (No. 58). Etiam ex insula Java accepi (sub nom. *Orthodontii infracti, Dozy et Molk*).
Species a reliquis *Trematodontium* collo brevi remota, sed habitu directioneque thecarum et collo quamvis brevi similis, transitionem *Trematodontium* in *Leptotrichum* ostendens. Caulis circiter quadrilinearis, pedunculus ejusdem longitudinis.

5. LEUCOLOMA, *Brid.*

1. L. Taylori. (Syrrhopodon, *Schw. Supp.* t. 132.)
Hab. In Nepal, *Wallich*! in Rangoon, *McLelland.*

2. L. TENERUM (*Mitten*). Caule unciali-sesquiuncali dichotomo curvato fusco-nigro gracili, foliis patulis flexuosis apicalibus sub-secundis lanceolatis tenuiter acuminatis, nervo gracili sub summo apice vix denticulato evanido, dorso lævibus, cellulis (ubi folia latissima sunt) triseriatis, serie interna cellulis oblongis obscuris, intermedia elongatis, exteriore scariosis hyalinis, alaribus exterioribus hyalinis, interioribus rubris.
Hab. In peninsula Malayana ad Moulmein, *Rev. J. Parish*!
A *L. molli* (C. Müller) insularum Javæ et Hongkong incola, quocum magnitudine convenit, foliis magis tortilibus patulis minus obscure viridibus sub-lutescentibus, dorso lævi nec papilloso, margine ad medium folii hyalino et cellulis in serie nervo proxima obscurioribus differt.

3. L. AMŒNE-VIRENS (*Mitten*). Caule decumbente curvato ramoso, foliis falcato-secundis e basi elliptica lanceolatis dorso lævibus nervo in apicem subdenticulatum evanido, cellulis oblongis minutis pellucidis margine angustis hyalinis, alaribus paucis incrassatis fusco-rubris.

Hab. In peninsula Indiæ orientalis ad Madras, *Wight*! in mont. Khasianis in rupibus ad torrentem Burtapanee dictum, *Griffith*! in insula Ceylon, *Gardner*!

L. Sieberi simillimum, sed foliis dorso lævibus minusque opacis.

6. Dicranum, *Hedw.*

* *Pedunculus erectus.*

1. D. edentulum (*Mitten*). Dioicum? caule decumbente ramoso, foliis patentibus e basi late ovali acuminatis concavis integerrimis, nervo tenui sub summo apice evanido, marginibus superne involutis, cellulis elongatis angustis, alaribus incrassatis intense flavo-fuscis, perichætialibus in cylindrum angustum pedunculum totum obvelantem convolutis, theca in pedunculo breviusculo ovali cylindrica ore parvo, operculo longe subulato-rostrato.

D. scariosum ex parte, *Wils. l. c.* p. 294.

Hab. In insula Ceylon, *Gardner* (No. 57, 60, 61).

D. macrocalyci (Eucamptodon, *C. Müller*) habitu, statura adspectuque persimile, sed paululum minor et foliis nervosis.

2. D. gymnostomum. Dioicum, habitu *D. scoparii*, foliis secundis lanceolato-subulatis latiusculis margine dorsoque superne serrulatis nervo angusto percurrente, cellulis elongatis parietibus crassiusculis valde interruptis, alaribus obscuris fuscis, perichætialibus interioribus in cylindrum longiusculum convolutis apiculis erectis brevibus, theca in pedunculo rubro elongato erecta inclinatave cylindracea æquali, ore parvo, operculo subulato-recte-rostrato, peristomio nullo nisi membranæ teneræ fragmenta, flore masculo nidulante.

D. rugulosum et D. Billardieri, *Wils. l. c.* pp. 294, 295.

Hab. In Himalayæ orient. reg. temp. et alp., *J. D. H.* (No. 67, 67 *b*, 70, 70 *b*).

D. scoparo, quoad magnitudinem, habitum coloremque, simillimum, sed foliis perichætialibus internis magis exsertis erectis et theca cylindracea gymnostoma. A *D. edentulo,* quocum forma thecarum convenit, foliis longe subulatis, perichætialibus in cylindrum vix foliis caulinis longiorem, pedunculo perichætio quadruplo longiore, et adspectu totius plantæ valde diversum.

3. D. himalayanum (*Mitten*). Dioicum? habitu *D. scoparii,* foliis falcatis secundis lanceolatis longe subulatis nervo angusto percurrente, marginibus integerrimis, cellulis elongatis angustis parietibus crassiusculis interruptis, alaribus fuscis distinctis, perichætialibus in cylindrum brevem convolutis, internis apice obtusissimis apiculo brevissimo nullove, theca in pedunculo elongato rubro ovali erecta æquali, operculo subulato oblique rostrato, peristomio parvo dentibus rubris integris dicranisque.—D. scariosum ex parte, *Wils. l. c.* p. 294.

Hab. In Himalayæ orient. reg. temp. et alp., Sikkim, *J. D. H.*! (No. 71, 71*b*, 88); in Kumaon, *Strachey et Winterbottom*!

D. gymnostomo gracilius, foliis caulinis integerrimis, perichætialibus non cuspidatis et peristomio perfecto.

4. D. assimile, *Hampe.* (D. scoparium, var., *Wils. l. c.* p. 295.)

Hab. In Himalayæ orient. reg. temp., *J. D. H.* (No. 50, 68); ad Madras, *Wight*!

5. D. brevisetum, *Dozy et Molk.* (Megalostylium *eorund., Musc. Archip. Ind.* t. xliv.)

Hab. In insula Ceylon, *Gardner*! (No. 56, 58, 59).

6. D. LORIFOLIUM (*Mitten*). Dioicum, habitu *D. scoparii*, foliis anguste lanceolatis loriformi-attenuatis, nervo sub summo apice evanido dorso superne carinis pluribus serratis exarato margine superne argute serrulato, cellulis elongatis parietibus angustis alaribus distinctis fuscis, perichætialibus in cylindrum convolutis internis e basi latissima vaginante subito in acumen loriforme sublæve attenuatis, theca in pedunculo elongato rubro cylindrica erecta, operculo subulato recto rostrato, peristomio dentibus rubris dicranis, flore masculo nidulante.

D. scoparium et D. cristatum, *Wils. l. c.* p. 295.—D. scoparium, *Griff. Not.* p. 417; *Icon. Plant. Asiat.* ii. t. lxxxii. f. 3.

Hab. In Nepal, *Wallich*! in Kashmir, reg. temp. *T. T.*! (No. 52); in mont. Khasia. reg. temp., *J. D. H.* et *T. T.*! (No. 63); ad Bogapanee, *Griffith*!

Habitus *D. scoparii* et *D. pallidi*, neque primo visu aliter discernibile nisi foliis paululum angustioribus minus nitentibus. A speciebus affinibus tamen folii cellulis parietibus angustioribus haud interruptis formaque folii angustiore argutius serrulata distinctum.

7. D. reflexifolium, *C. Müller, Syn.* i. p. 282. (D. brevisetum ex parte, *Wils. l. c.* p. 295.)

Hab. In mont. Khasia, reg. temp., *J. D. H.* et *T. T.* (No. 53); in Assam, *Griffith*! in Nepal, *Wallich*!

A *D. breviseto* distinctissimum.

8. D. palustre, *Brid.* (D. scoparium ex parte, et D. palustre, *Wils. l. c.* p. 295.)

Hab. In Himalayæ orient. reg. temp, Sikkim, *J. D. H.*! (No. 506); in Himalayæ boreali-occident. reg. temp., *T. T.* (No. 62).

9. D. fragile, *Hook., Musc. Exot.* t. 134. (D. cuspidatum, *Griff. Not.* p. 416; *Icon. Plant. Asiat.* ii. t. xciv. f. iv.)

Hab. In Nepal, *Wallich*! in mont. Khasia, reg. subtrop. et temp., *J. D. H.* et *T. T.*! (No. 54, 54 *b*); in pinetis Moflong, *Griffith*!

Specimina Griffithiana a Wallichianis differentiam nullam ostendunt, forsan Griffith ideam suam *D. fragilis* a figura Hookeri desumpsit; nam in icone citato folium caulinum nimis longum et angustum delineatum est.

10. D. Bergeri, *Bland.*
Hab. In Himalayæ orient. reg. temp., Sikkim (inter *Cladonias*), *J. D. Hooker*!

11. D. enerve, *Thed.* (Campylopus crassinervis, *Wils. l. c.* p. 297.)
Hab. In Himalayæ orient. reg. alp., Sikkim (inter *Cladonias*), *J. D. Hooker*! (No. 66, 66 *b*, 66 *c*, 66 *d*, 66 *e*).
Invenitur etiam in Caucaso, Helvetia, Scandinavia, Britannia, et in America boreali-occidentali.

12. D. DECIPIENS (*Mitten*). Caule gracili radiculoso, foliis laxis patentibus supremis falcatis secundis anguste lanceolatis attenuatis, nervo lato tenui indistincto medio intensius colorato totam fere folii latitudinem occupante, marginibus involutis apice parce serrulatis, cellulis basi laxis alaribus paululum ventricosis laxis pallide fuscis.
D. cerviculatum et D. lubricum, *Wils. l. c.* pp. 296, 297.
Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. H.*! (No. 87); in mont. Khasia, reg. subtrop., inter *D. fragile*, *J. H. D.* et *T. T.* (No. 87 *b*).
Primo adspectu *D. longifolio* non dissimile, sed gracilius. Folia quamvis in sectione transversali nervum latissimum exhibent e colore saturatiore in nervi medio evidentiore, quasi angusto-nervata.

** *Pedunculus flexuosus* (Campylopus).

13. D. NILGHIRIENSE (*Mitten*). Dioicum, *D. nivali* simillimum, caule non nodoso-interrupto, foliis e basi latiore subulatis setaceis, nervo inferne $\frac{3}{5}$ folii latitudinis occupante, cellulis basi angustis elongatis marginalibus tenerrimis alaribus paucis teneris hyalinis, perichætialibus internis convolutis, theca in pedunculo flexuoso ovali siccitate plicata, operculo subulato obliquo, peristomio dentibus rubris dicranis, calyptra basi nuda.
D. nivale ex parte, *C. Müller, Syn.* i. p. 393.—D. Perrottetii ex parte, *Mont.*
Hab. In mont. Nilghiri, *Perrottet*, *Gardner*! *Foulkes*!
D. nivali (Brid.) simillimum, sed notis datis distinctum. In specimine Borbonico *D. nivalis* folia e basi nervo $\frac{4}{6}$ folii latitudinis occupante parallela insensibiliter angustata.

14. D. albescens, *C. Müller, Bot. Zeit.* 1853, p. 36.
Hab. In mont. Nilghiri, *Schmid.*!

15. D. densum, *Schl.* (Campylopus fragilis, *Bryol. Europ.*)
Hab. In mont. Nilghiri, *Schmid.*!

16. D. nitidum (Campylopus), *Dozy et Molk., Musc. Archip. Ind.* t. xliii.
Hab. In Ceylon, *Maxwell*! *Gardner*! (No. 74). Etiam in Java, *Junghuhn*!

17. D. LATINERVE (*Mitten*). Dioicum, cæspitosum, caule humili erecto dichotomo, foliis patentibus lanceolatis rigidis concavis, nervo latissimo basi $\frac{3}{5}$ folii latitudinis superne totam occupante apice parce denticulato, cellulis basi elongatis teneris alaribus paucis pallidis, perichætialibus basi elongata latiori in tubulum convolutis subulatis acuminibus lævibus; theca in pedunculo elongato cygnicolli-arcuato elliptico-ovali siccitate plicata basi rugulosa, operculo conico subulato subrecto-rostrato, peristomio dentibus rubris dicranis annulo latiusculo, calyptra basi fimbriata.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 23, 26, 80, 87 *b*). In Nepal. orient., *J. D. Hooker* (No. 87 *d*). In mont. Nilghiri, *G. Thomson*! (No. 90 *b*). In Ceylon, *Gardner*! (No. 90).

Hujus speciei typum dant specimina sub No. 80 memorata; reliqua imperfecta sed proxime huic referenda. *D. Goughii* gracilius, nervo latiore et theca basi rugulosa. A *D. ericoide* foliis superne minus attenuatis parcius denticulatis et perichætialibus apicibus subintegerrimis distinctum. *D. Nilghiriense* structura foliorum simile, sed minus et calyptra fimbriata.

18. D. GRACILE (*Mitten*). Dioicum, cæspitosum, sericeum, caule dichotomo radiculis pallidis parce vestito, foliis erecto-patentibus lanceolatis longe attenuatis basi nervo $\frac{6}{8}$ folii latitudinis superne totam occupante concavis apice subintegerrimis, cellulis parvis angustis alaribus paucis pallidis, perichætialibus e basi lata convoluto-subulatis; theca in pedunculo arcuato ovali-cylindrica æquali siccitate plicata, operculo subulato recto-rostrato, peristomio dentibus rubris dicranis, calyptra basi fimbriata.

D. sericeum, *Wils. l. c.* p. 297; non *C. Mülleri.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. H.* (No. 69, 72).

D. nitido simile, sed gracilius, foliis nervo latiore, theca angustiore in pedunculo arcuato haud cygnicolli-flexo. A *D. latinervi* foliis magis attenuatis diversum.

19. D. pyriforme, *Schultz.* (D. turfaceum, *C. Müller, Syn.* i. p. 399.—D. pinetorum, *Griff. Not.* p. 419; *Icon. Plant. Asiat.* ii. t. xciv. f. iii.)

Hab. In mont. Khasia., Moflong (ad truncos pinorum), *Griffith*!

Theca in speciminibus Griffithianis plicata, quamvis ab auctore "estriatis" descripta.

20. D. GOUGHII (*Mitten*). Dioicum, dense cæspitosum, luteum, nitidum, caule dichotomo inferne fusco-radiculoso, foliis patenti-appressis lanceolato-subulatis concavis, nervo lato dimidium folii latitudinis occupante apice parce serrulato, cellulis firmis alaribus paucis pallidis, perichætialibus e basi latiore convoluto-subulatis; theca in pedunculo breviusculo cygnicolli-flexuoso ovali sub-æquali, operculo subulato oblique rostrato, peristomio rubro dentibus dicranis, calyptra basi nuda crenata.

Campylopus compactus, ex parte, *Wils. l. c.* p. 297.

Hab. In mont. Nilghiri, *Gough* ! *et Gardner* ! In Himalayæ reg. temp., Nepal. *Wallich* ! Sikkim, *J. D. H.* ! (No. 79 *b*). In mont. Khasia. reg. sub-trop. *J. D. H. et T. T.* ! (No. 86).

D. denso simile sed compactius, foliis firmioribus, basi aliter conformatis, et calyptra basi nuda. A *D. flagellifero* structura foliorum et cellularum alarium diversum.

21. D. Walkeri (*Mitten*). Dioicum, gracile, erectum, caule inferne fusco-radiculoso innovationibus tenuibus appressifoliis subjulaceis infra perichætium comosum orientibus ramoso, foliis caulinis erectis lanceolatis concavis, nervo basi tertiam partem folii latitudinis occupante apice tantum parce minute serrulato, cellulis basi elongatis laxis superne in oblongas transeuntibus alaribus teneris pallidis, perichætialibus e basi lata longe convoluta longe subulatis; theca in pedunculo elongato sicco et humido erecto flexuoso horizontali subpyriformi inæquali, siccitate plicata arcuata, ore obliquo, collo strumoso lævi, peristomio rubro, dentibus dicranis.

Hab. In Ceylon, *Walker* !

Habitu *D. comosi*, sed partibus omnibus minus, foliis cellulis alaribus teneris fragilibus. Theca basi strumosa, ore inæquali, et siccitate arcuata.

22. D. flagelliferum, *C. Müller, Bot. Zeit.* 1853, p. 35. (Campylopus Perrottetii ex parte, *Mont.*)

Hab. In mont. Nilghiri, *Perrottet* ! *Foulkes* ! *Schmid* ; *Gough* !

23. D. reduncum, *Hornsch. et Reinw., C. Muller, Synops.* i. p. 396.

Hab. In insula Ceylon, *Gardner* ! (No. 89).

24. D. ericoides, *Griff. Not.* p. 420.

Hab. In Nepal., *Wallich* ! In mont. Khasia., in sylvis Myrung, *Griffith* !

Primo adspectu *D. pyriformi* simillimum, structura autem *D. flagellifero* affinius, a quo theca basi aspera et calyptra fimbriata recedit. Folia perichætialia argute serrata.

25. D. involutum, *C. Müller, Bot. Zeit.* 1853, p. 34.

Hab. In mont. Nilghiri, *Schmid.*

26. D. caudatum, *C. Müller, Syn.* i. p. 401.

Hab. In mont. Nilghiri, *Perrottet et Gardner* !

27. D. sordidum (*Wils. l. c.* p. 297). Caule erecto brevi, foliis lanceolatis subulatis patentibus nervo mediocri percurrente, apice parce serrulato, cellulis basi oblongis mox in elongatas transeuntibus, alaribus rubris totam baseos latitudinem occupantibus.

Hab. In Nepal. orient. reg. temp. inter specimina *Bryi teretiusculi*, *J. H. D.* ! (No. 31).

Species obscura; specimina imperfecta facie *D. uncinati*, sed structura foliorum aliena, probabiliter hujus loci.

28. D. SUBLUTEUM. Cæspitosum, robustum, luteum, nigrescens, caule dichotomo, foliis erecto-patentibus siccitate appressis imbricatis e basi subovato-oblonga derepente subulatis apice tantum minute denticulatis, nervo basi tertiam folii latitudinis in parte subulata totam occupante, cellulis basi firmis exterioribus angustissimis interioribus latioribus alaribus teneris pallidis.

Hab. In peninsula Malayana ad Moulmein, *Rev. D. Parish*! et ab India orientali absque loco, *Davies*! In Hb. Mitten.

Habitu *D. læto D. nigrescentique* simile, foliis autem e basi elongato-ovata oblongata subito angustatis subulatis diversum.

29. D. NIGRESCENS (*Mitten*). Dioicum, cæspitosum, habitu *D. exasperati*, foliis patentibus e basi elliptica lanceolatis, nervo $\frac{1}{5}$ folii latitudinis occupante apice hyalino minute serrulato, cellulis parvis quasi a nervo oblique divergentibus alaribus paucis pallidis, perichætiis aggregatis, foliis basi latioribus, theca in pedunculo brevi cygnicolli-flexo elliptica plicata, collo tuberculoso scabro, operculo subulato recto rostrato, peristomio dentibus angustis pallide rubris, annulo lato composito, calyptra basi fimbriata.

D. exasperatum, *Griff. Not.* p. 421; *Icon. Plant. Asiat.* t. xciv. f. 1.—D. Dozyanum, *Wils. l. c.* p. 298.

Hab. In Himalayæ orient. reg. temp. Sikkim, *J. D. H.*! (No. 73, 78, 92, 93). In mont. Khasia, ad rupes in locis apertis Churra Pungee, *Griffith*! et in regione temp. *J. D. H. et T. T.*! (No. 77). Behar ad Mont. Paras-Nath, reg. sub-trop., *J. D. H.* (No. 82). In Ceylon, *Gardner*! (No. 76, 76 *b*, 85).

D. exasperato paululum gracilius, polymorphum, nunc caulibus gracilibus, foliis appressis apice capituliferis, nunc caule interrupte folioso et interdum foliis per caulem homomallis.

30. D. LÆTUM (*Mitten*). Cæspitosum, caule radiculis tomentoso dichotomo elongato, foliis patentibus late lanceolatis subulatis apice marginibus dorsoque serrulatis, nervo tertiam folii latitudinis occupante, cellulis basi quadratis sensim in oblongas rotundatas oblique depressas transeuntibus, alaribus pallide fuscis non dilatatis.

D. No. 10, *Griff. Not.* p. 423.

Hab. In mont. Khasia, reg. temp., *J. D. H.*! (No. 84); Churra Pungee ad rupes humidas, et Nunklow ad pinorum truncos, *Griffith*!

"Pulchrum, dense cæspitosum, læte luteo-nitens," *Griffith, l. c.*—*D. nigrescenti* simillimum, sed structura foliorum baseos certe diversum.

31. D. THWAITESII (*Mitten*). Caule elongato prolifero ramoso, foliis comalibus patentibus innovationum appressis cuspidem formantibus lanceolatis attenuatis, marginibus dorsoque apicem versus serrulatis, nervo crasso dimidium folii latitudinis occupante summo apice hyalino, cellulis elongatis firmis conformibus, alaribus copiosis ventricosis intense rubro-fuscis.

Hab. In Ceylon, *Gardner*! *et Thwaites*!

D. nigrescenti habitu simile, differt structura foliorum autem et forma a cellulis alaribus, ubi latiora sunt, sensim angustatis.

32. D. RECURVUM. Dioicum, caule elato flexuoso ramoso, foliis patenti-recurvis lanceolatis, nervo dimidium folii latitudinis occupante, apice hyalino marginibusque superne parce denticulatis, cellulis minutis conformibus alaribus paucis externis hyalinis internis rubris, perichætiis aggregatis foliis brevioribus e basi late convoluta subulatis integerrimis; theca in pedunculo brevi cygnicolli-flexo ovali, collo tuberculoso scabro, peristomio dentibus rubris dicranis.

Hab. In mont. Nilghiri, *Gardner*! In Ceylon, *Fraser*! *et Thwaites*!

Formis majoribus *D. pilifero* (Turn.) simile, caulibus bi-triuncialibus innovationibus hic illic prodeuntibus, foliis in caulium apicibus statu sicco vel humido patenti-recurvis. A *D. nigrescente* foliis longioribus, nervo crassiore et thecarum ore majore recedit. A *D. Dozyano* et *D. atrovirente* cellulis folii a basi infima conformibus, haud fere ad medium e cellulis tenerioribus conformatum, diversum.

33. D. ERICETORUM (*Mitten*). Dioicum, dense cæspitosum, plus minus robustum, rigidum, erectum, parce dichotome ramosum, viride, fuscum, nigrescens, subopacum nitidumve, ramis sterilibus cuspidatis, fertilibus rosulatis, foliis caulinis late lanceolatis attenuatis, nervo basi $\frac{1}{2}$ folii latitudinis occupante dorso lamelloso apice in pilum hyalinum strictum serratum producto marginibus superne incurvis subintegerrimis, cellulis alaribus paucis parvis rubris fuscisve inde cellulis elongatis pallidis tenerrimis in superioribus minutis coloratis abrupte quasi linea a nervo ad marginem oblique adscendente transeuntibus, perichætiis aggregatis foliis basi ovali-elliptica convolutis teneris, nervo angusto longe excurrente, apice hyalinis denticulatis, theca in pedunculo breviusculo cygnicolli-flexuoso ad capsulæ collum scabro ovali æquali basi scabra siccitate plicata, operculo conico acuminato recto, peristomio dentibus angustis rubris dicranis, annulo composito, calyptra basi fimbriata.

Campylopus longipilus, *Brid. et auctorum.* (C. Dicranum clavatum, *R. Br.*, *Wils. l. c.* p. 298.—Dicranum Dozyanum, *C. Müller*, *Syn.* i. p. 385.)

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. H.* (No. 81). In mont. Nilghiri, *McIvor* ! *et Gardner* ! In Ceylon, *Gardner* (No. 75). In Assam, *Griffith* ! et in Java, *Junghuhn* !

Etiam per Europam meridionalem in Lusitania ! Hispania ! Italia, necnon in Madeira insula ! in ericetis inter *Polytricha*. In Gallia in sylva prope Fontainebleau ! et prope Angers ! unde habuit ipse Bridel.

Species hucusque auctoribus a Bridelio in errorem ductis cum *D. flexuoso γ pilifero* Turneri commutata, foliorum autem substantia supra descripta diversa. *D. piliferum* Turneri foliis longius subulatis basi cellulis alaribus fuscis firmis, deinde cellulis sensim abbreviatis firmis areolatis, et colore nigriore intensiore subnitente differt. *D. clavatum* R. Br.,

species australis, a *D. ericetorum* satis est diversum et potius *D. pilifero* comparandum.

34. D. tricolor, *C. Müller, Bot. Zeit.* 1853, p. 36.
Hab. In mont. Nilghiri, *Schmid.*
E descriptione a *D. ericetorum* vix diversum videtur.

35. D. erythrognaphalon, *C. Müller, Bot. Zeit.* 1853, p. 37.
Hab. In mont. Nilghiri, *Schmid.*

36. D. Schmidii, *C. Müller, Bot. Zeit.* 1853, p. 37.
Hab. In mont. Nilghiri, *Schmid.*

37. D. nodiflorum, *C. Müller, Bot. Zeit.* 1837, p. 38.
Hab. In mont. Nilghiri, *Schmid.*

38. D. uncinatum (Thysanomitrion), *Harvey.* (D. circinatum, *Wils. Bryol. Brit.*—Dicranodontium asperulum, *Wils. l. c.* p. 296.)
Hab. In Himalayæ reg. temp., Nepal. *Wallich*! Sikkim, *J. D. H.*! (No. 11 *b*, 18, 19, 81 *b*). In mont. Khasia, reg. trop. et temp., *J. D. H. et T. T.* (No. 64, 72 *b*, 77 *b*); et in rupibus humidis Sururcem, *Griffith*! Etiam in montibus Helvetiæ, Scandinaviæ, et Britanniæ.

39. D. dicticyon (*Mitten*). Dioicum, cæspitosum, caule dichotomo curvato, foliis falcatis secundis e basi sub-ovata subulatis, nervo crassiusculo subulam totam occupante superne, dorso subscabro, marginibus apicem versus minutissime serrulatis, cellulis folii in parte ovata distincte dimorphis, interioribus oblongis parallelogrammaticis pellucidis, marginalibus multo angustioribus limbum viridem formantibus, alaribus ventricosis laxissimis hyalinis, perichætialibus basi late convolutis, theca in pedunculo brevi sicco recto humido flexuoso ovali æquali, peristomio dentibus rubris dicranis.
D. uncinatum, *Wils. in Sched. l. c.* p. 296.
Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. H.*! (No. 27, 27 *b*, 51, 51 *b*).
D. uncinato simile, sed robustius, foliis magis falcatis basi conspicue latioribus et cellulis distincte dimorphis, species generum *Calymperis* et *Syrrhopodontis* simulans.

40. D. didymodon, *Griff. Calcutta Journ. Nat. Hist.* ii. p. 499. (Didymodon dicranoides, *ejusd. Not.* p. 435; *Icon. Plant. Asiat.* ii. t. lxxxii. f. ii.—D. relaxum, *Wils. l. c.* p. 294.)
Hab. In mont. Khasia, reg. temp. et subtrop. *J. D. H. et T. T.*! (No. 65). In sylvis Myrung et ad truncos in pinetis Moflong, *Griffith*!
D. uncinato affine, sed structura foliorum cellularum ad folii basin, ubi cellulæ majores vix conspicuæ sunt, et peristomio pallido differt. Fructiferum non vidi.

41. D. CÆSPITOSUM, dioicum, cæspitosum, caule brevi dichotomo, foliis patentibus, apicalibus falcatis secundis, e basi latiuscula sensim angustatis, nervo crassiusculo partem superiorem totam occupante, vix scaberulis, basi cellulis majoribus sensim in angustiores transeuntibus alaribus magnis hyalinis, perichætialibus basi latis convolutis; theca in pedunculo breviusculo flexuoso ovali æquali, peristomio ?...

Dicranodontium asperulum ex parte, *Wils. l. c.* p. 296.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* ! (No. 11).

D. uncinato minus, foliis a basi infima haud ovata sensim subulato-lanceolatis, cellulis interioribus altius in folium protractis.

42. D. ASPERULUM (*Mitten*). Dioicum? cæspitosum, caule decumbente dichotomo, foliis falcato-secundis e basi subovata subulatis, nervo latiusculo totam subulam fere occupante, marginibus dorsoque pulchre arcteque serrulatis, cellulis laxis pellucidis alaribus magnis hyalinis copiosis, perichætialibus basi latissimis vaginantibus cæterumque conformibus, theca in pedunculo elongato luteo tortili erecta ovali-cylindrica ætate plicata, operculo subulato rostrato recto, peristomii dentibus rubris dicranis.

Dicranodontium asperulum ex parte, *Wils. l. c.* p. 296.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* ! (No. 18, 29).

Habitu facieque *Leptotrichi heteromalli*, foliis pulchre serrulatis, cellulis basi laxis et alaribus magnis pallidis ab affinibus facile cernibile.

43. D. ATTENUATUM (*Mitten*). Dioicum, cæspitosum, caule furcato, foliis falcatis secundis e basi lanceolata longe tenuiter attenuatis concavis, nervo latissimo rigido totam fere partem superiorem et basi $\frac{3}{5}$ folii latitudinis occupante, integerrimis lævibus, cellulis basi in folii medio conspicuis marginalibus angustioribus alaribus teneris hyalinis, perichætialibus e basi lata convoluta subulatis; theca in pedunculo humido spiraliter flexuoso sicco recto ovali æquali, operculo subulato recto-rostrato, peristomii dentibus rubris dicranis, calyptra basi integra.

Dicranodontium attenuatum, *Wils. l. c.* p. 297.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* ! (No. 78 *b*).

A *D. asperulo* quocum crescit et habitu convenit, nervo crasso lato recedit, formis minoribus *D. longifolii* non dissimile, sed pedunculus flexuosus.

7. DIDYMODON, *Hook.*

Didymodon ex parte quoad D. flexifolium, Cynodontium ex parte, Weissia ex parte quoad W. serrulatam, Dichodontium, Rhabdoweissia et Amphidium (*Schimper, Corol.*), Angstrœmia et Trichostomum ex parte (*C. Müller, Synops.*), Ceratodon (*Brid.*).

Species quas sub hoc nomine enumero inter se adeo affines sunt ut in

genera plura characteribus fere nullis discreta non separavi. Nam inter Didymodontes europæos (*e. g.* D. flexifolium *Smith*, Weissiam serrulatam *Funk*, Cynodontium polycarpum et C. gracilescentem *Schimp.*, necnon Rhabdoweissias et species illas quas a Müllero inter Zygodontes a Schimpero pro genere Amphidio militant, tamen a Rhabdoweissiis nullo charactere nisi peristomii defectu diversas), differentias specificas tantum invenio. Ceratodon etiam a speciebus thecis striatis tantillum recedit; peristomii structura a Dicrano non diversa.

1. D. squarrosus, *Hook. Musc. Exot.* t. 150.
Hab. In Himalayæ reg. temp., Nepal. *Gardner*! *Wallich*! Sikkim, *J. D. Hooker*! (No. 102, 116). In mont. Khasia, reg. temp. et subtrop., *J. H. D. et T. T.*! (No. 123). In pinetis, Moflong, *Griffith*!
Huic proxime accedit *D. Neesii*, foliis paulo supra basin latioribus inde lanceolatis sensim acutis nervo carinatis, margine inferne recurvo apicem versus serrulato, perichætialibus interioribus elongatis convolutis sensim longe angustatis erectis, cæteroquin *D. squarroso* valde affine. *Hab.* In Java insula, *Nees ab Esenbeck in Herb. Hooker.*, sub nom. *D. squarrosi.* Foliis superne angustioribus et perichætialibus multo longioribus angustioribusque a *D. squarroso* diversus videtur.

2. D. gracilescens. (Dicranum, *Web. et Mohr.*—D. polycarpum, *Wils. l. c.* p. 295.)
Hab. In Himalayæ orient. reg. alp., Sikkim, *J. D. Hooker*! (No. 106).

3. D. laxifolius. (Grimmia, *Hook. fil. in Hook. Icon. Plant. Rar.* t. 194, B.—G. flaccida, *Royle.*—Weissia serrulata, *Wils. l. c.* p. 291.)
Hab. In Himalayæ reg. temp., Sikkim, *J. D. Hooker* (No. 103, 104, 105, 107). Kumaon, *Strachey et Winterbottom*! *Royle*!
D. serrulato (Weissia *Funk*) simillimus, foliis autem laxioribus latioribus et theca firmióre diversus esse videtur.

4. D. DENTATUS (*Mitten*). Caule erecto innovante, foliis patenti-recurvis elliptico-lanceolatis margine inferne recurvis superne dentatis nervo sub apice evanido carinatis, cellulis basi oblongis pellucidis superne rotundatis obscuris dense papillosis.
Trichostomum dentatum ex parte, *Wils. l. c.* p. 299.
Hab. In Himalayæ orient. reg. temp., Sikkim, ad corticem arborum vetustarum, *J. D. Hooker*! (No. 114, 267).
D. flexifolio maxime affinis, sed statura majore et foliis rigidioribus acutioribus discrepans.

5. D. CRENULATUS (*Mitten*). Monoicus, caule dichotomo, foliis laxis patentibus flaccidis ligulatis obtusis acutisve planiusculis e medio ad apicem crenulato-serratis, nervo sub summo apice evanido, cellulis inferne elongatis hyalinis superne subquadratis ob utriculum primordialem subobscuris, perichætialibus conformibus; theca in pedunculo

brevi gracili ovali ætate plicata, peristomii dentibus angustis rubris siccitate erectis apicibus incurvis.

Rhabdoweissia denticulata, *Wils. l. c.* p. 293.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 270).

D. denticulato (*Rhabdoweissia,* Bryol. Euror.) flaccidior, foliis duplo latioribus et cellulis majoribus distinctus.

6. D. stenocarpus. (Ceratodon, *B. & S.*)

Hab. In mont. Nilghiri, *Perrottet et Schmid*! in Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 191).

A *D. purpureo* vix, nisi colore luteo, diversus.

8. Holomitrium, *Brid., Hornsch.*

Sprucea dein Symblepharis, *Wils.*; Weissia ex parte, *auct.*, et Syrrhopodon ex parte, *C. Müller, Synops.*

1. H. Griffithianum (*Mitten*). Dioicum? cæspitosum, caule furcatim ramoso, foliis e basi erecta suboblonga patenti-incurvis lanceolatis apice acutatis, nervo crasso sub apice evanido, marginibus medio subincrassatis integerrimis, cellulis basi angustis elongatis superne minutis rotundatis ubique distinctis lævibus alaribus majoribus fuscis, perichætialibus interioribus corrugatis lanceolatis attenuatis convolutis, theca in pedunculo luteo ovali-cylindrica, operculo subulato, peristomio *H. perichætialis.*

Didymodon perichætialis, *Griff. Not.* p. 434; *Icon. Plant. Asiat.* pl. lxxx. f. 1.—Symblepharis densifolia, *Wils. l. c.* p. 292.

Hab. In mont. Khasia, reg. temp, ad rupes arboresque Myrung et Nunklow, *Griffith*! Kollong, *J. D. H. et T. T.*! Assam, *Simons*!

Formis gracilioribus *H. perichætialis* Brid. simile, sed caule magis elongato, seta breviore, foliis perichætialibus dimidio longioribus, foliis caulinis brevioribus apice obtusiusculis subcucullatis margine medio ut in speciebus affinibus obscure incrassatis, cellulis magis approximatis, unde folia obscuriora.

2. H. indicum (*Mitten*). Monoicum, caule erecto sæpe furcato, foliis patentibus incurvis e basi latiuscula sensim angustatis longiusculis, marginibus superne incurvis integerrimis, nervo percurrente, cellulis basi angustis elongatis superne rotundatis minutis distinctis alaribus copiosis fuscis ventricosis, perichætialibus intimis longioribus basi vaginantibus, theca in pedunculo longiusculo rubro erecta cylindrica, operculo brevi conico-rostrato, peristomii dentibus æquidistantibus lanceolatis rubris, flore masculo axillari lateralique gemmiformi.

Weissia indica ex parte, *Wils. l. c.* p. 292, et Leptotrichum tortuosum *ejusdem*, p. 321.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 28 *b.* ex parte, 42).

H. crispulo (*Weissia* Hedw.), facie habituque simile, sed partibus

omnibus major, pedunculo longiore rubro, theca duplo longiore cylindrica, operculo brevi, et foliis minus crispatis.

3. H. crispulum (Weissia, *Hedw.*).

Hab. In Himalayæ orient. reg. temp. et alp., Sikkim, *J. D. Hooker* (No. 28 *b*. ex parte).

4. H. ALPINUM *Mitten*). Monoicum, caule furcato elongato, foliis patentibus subfalcatis e basi ovata subulatis firmis marginibus superne incurvis integerrimis, nervo crassiusculo percurrente, cellulis basi elongatis superne rotundatis vix distinctis alaribus magnis numerosis fuscis parum ventricosis, perichætialibus interioribus e basi lata ovalibus vaginantibus longe subulatis, theca in pedunculo rubro cylindrica, operculo subulato, peristomio?....

Weissia indica ex parte, *Wils. l.* c. p. 291.

Hab. In Himalayæ orient. reg. alp., Sikkim, *J. D. Hooker*! (No. 118).

H. indico simile, sed foliis e basi latiore subulatis firmioribus et operculo subulato diversum. Ab *H. crispulo* foliis firmioribus, theca cylindrica et statura duplo majore satis recedere videtur.

§ II. LEUCOBRYACEÆ, *C. Müller*.

1. LEUCOPHANES, *Brid.*

1. L. glaucus. (Syrrhopodon, *Schw.* t. 181.—L. cuspidatus, *C. Müller, Synops*. i. p. 83.)

Hab. In Nepal.? *Wallich*!

2. L. octoblepharoides, *Brid.* i. p. 763.

Hab. In Nepal. *Wallich*!

2. OCTOBLEPHARUM, *Hedw.*

1. O. albidum, *Hedw.*

Hab. In Himalayæ reg. trop., Nepal., *Wallich*! Sikkim, *J. D. Hooker* (No. 1280). In Concan, *Stocks*! et in Ceylon, *Gardner*! (No. 1281).

3. LEUCOBRYUM, *Hampe.*

1. L. javense. (Sphagnum *Brid.* i. p. 19.—L. falcatum, *C. Müller, Synops*. i. p. 79; *Dozy et Molk., Bryol. Javan.* t. xiv.)

Hab. In Himalayæ centralis reg. temp., Nepal. *J. D. Hooker* (No. 1270, 1271). In mont. Khasia, reg. temp., *J. D. H. et T. T.*! (No. 1276). In Ceylon, *Gardner*! (No. 1278).

Etiam in Java! Borneo! et Hong Kong!.

2. L. sanctum, *Hampe, Dozy et Molk., Bryol. Jav.* t. xii.

Hab. In Nepal. *Wallich*. (Etiam in insulis Java et Aneiteum.)

3. L. WIGHTII (*Mitten*). Dense cæspitosum, caule subsimplici, foliis laxe subspiraliter apice cuspidato imbricatis elliptico-lanceolatis superne convolutis acutis dorso dentatis transverse rugosis, cellulis marginalibus circiter triseriatis (in folii pagina).

Hab. In peninsula Madras, *Wight*!

L. adunco simile, sed statura majore foliis superne angustioribus in caulium apicibus cuspidato-imbricatis, cellulis marginem versus nec minoribus nec abbreviatis.—*Dicranum glaucum,* Griff. Not. p. 415, cujus specimina non vidi, species plures probabiliter complectit.

4. L. aduncum, *Dozy et Molk. Bryol. Javan.* t. xi. (L. brachyphyllum, *Wils. l. c.* p. 293.)

Hab. In Himalayæ orient. reg. temp., Nepal. *J. D. Hooker*! In Penang, *Wallich*!

5. L. Nilghiriense, *C. Müller, Bot. Zeit.* 1854, p. 556. (L. vulgare, *Wils. l. c.* p. 293.)

Hab. In mont. Khasia, reg. temp., *J. D. H. et T. T.*! (No. 1277). In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (fragmentum).

Specimina sterilia forsan huic pertinentia.

6. L. Bowringii (*Mitten*). Cæspitosum, caule fasciculato ramoso, foliis patentibus e basi elliptica longe subulatis convolutis acutis, cellulis marginalibus 6–9-seriatis angustis elongatis apice denticulo uno alterove instructis dorso lævibus, perichætialibus basi longiore convolutis; theca in pedunculo elongato gracili ovali siccitate plicata basi strumosa ore obliquo.

L. angustifolium, *Wils. l. c.* p. 293.

Hab. In mont. Khasia, reg. temp., *J. H. D. et T. T.*! (No. 1272, 1275). In Ceylon, *Gardner*! (No. 1279). Etiam in Hong Kong, *Bowring*!

Habitu *L. gigantei,* sed statura *L. sancto* similius. A speciebus omnibus indicis foliis angustis statim dignoscitur.

4. Schistomitrium, *Dozy et Molk.*

1. S. Gardnerianum (*Mitten*). Conferte cæspitosum, caule erecto subsimplici, foliis dense imbricatis erecto-patentibus lanceolatis apice obtusiusculis apiculatis marginibus inflexis concavis e basi ad medium tenuiter hyalino marginatis, cellulis cæteris elongatis parallelogrammaticis conformibus, perichætialibus paululo latioribus, theca in pedunculo brevissimo immersa hemisphærica cyathiformi, operculo e basi conica longe subulato rostrato, peristomio nullo, calyptra longissime anguste subulata basi lacera laciniis breviter fimbriatis.

Leucophanes Gardnerianum, *C. Müller, Synops.*

Hab. In Nepal.? *Wallich*! In peninsula Malayana ad Moulmein, *Parish*! ad Madras, *Wight*! In mont. Khasia, reg. subtrop., *J. D. H. et T. T.*! No. 1274, specimen sterile, ut videtur, huc referendum.

Etiam in Hong Kong, *Bowring*! In Brasilia, *Gardner*! In Mexico ad Oaxaca in sylvis, alt. 3000 ped. cum *Octoblepharo albido* consociata, *Galeotti*!

Pulvinate cæspitosum. *Caules* vix unciales, in statu sterili vix a *Leucobryo glauco* primo visu distinguendæ. *Theca* parva inconspicua. *Calyptra* longissima thecam pedunculumque superans sed non ultra basin operculi protracta et cum illo decidens.

§ III. Trichostomaceæ.

Pottiaceæ *C. Müller*, Phascaceæ, Ephemeræ ex parte, Weissiaceæ ex parte, Anœctangiaceæ, Pottiaceæ ex parte, et Encalyptaceæ *Schimp. Coroll.*

Peristomium dentibus sæpe profunde fissis, cruribus elongatis angustis spiraliter tortis, in genere *Encalypta* duplex. Folia cellulis superioribus rotundatis quadratisve, inferioribus elongatis sæpe pellucidis.

1. Weissia, *Hedw.*

1. W. controversa, *Hedw.*

Hab. In Himalaya maxime occidentali ad Kashmir, *T. Thomson*! In Ceylon insula, *Gardner*! (No. 271, 272, 273).

2. W. edentula (*Mitten*). *W. controversæ* habitu, magnitudine florescentiaque simillima; theca in pedunculo gracili luteo ovali leptodermi macrostoma, operculo conico subulato-rostrato, peristomio nullo.

Hab. Ad Madraspatanam in muris, *Wight*!

A *W. controversa* theca tenuiore, vestigio nullo peristomii, sicca evacuaque suburceolata diversum videtur. *W. linearifolia*, Hornsch., species Javanica et Sinensis a *W. controversa* vix recedens, non inter *Seligerias*, ubi a cl. C. Müller enumerata, locanda est.

3. W. recurvirostris. (Bryum, *Dicks.*—Trichostomum rubellum, *C. Müller, Synops.* i. p. 581.)

Hab. In Tibet occid. reg. temp., *T. Thomson*! (No. 120, 144, 152, 182).

2. Tortula, *Hedw.*, ex parte.

Barbula et Trichostomum ex parte *auctorum.* Plantæ lutescentes. Folia crispa.

1. T. squarrosa, *Brid., de Not.*

Hab. In Himalayæ boreali-occident. reg. temp., *T. Thomson*! (No. 158).

2. T. Drummondii. (Didymodon fragilis, *Hook. et Wils. in Drumm. Musc. Amer.* No. 127; Barbula, *Bryol. Europ.* Supp. t. iv.)

Hab. In Himalayæ orient. reg. alp., Sikkim inter cæspites *Oreadis Martianæ, J. D. Hooker*!

Nomen specificum fragile jam a beato Taylor alii speciei *Barbulæ* impositum.

3. T. duriuscula. Dioica, cæspitosa, lutea, senior fuscescens, caule dichotomo elongato, foliis patentibus siccitate crispatis e basi brevi latiore sensim lineari-lanceolatis apice acutatis, nervo crasso luteo excurrente, carinatis marginibus integerrimis papillis erosulis, cellulis basi elongatis, parallelogrammaticis pellucidis sensim in parvas rotundatas obscuras papillosas transeuntibus, perichætialibus basi lata ovata convoluta, theca in pedunculo elongato rubro cylindracea erecta cur-

vatave, operculo subulato theca dimidio breviore, peristomii dentibus brevissimis *Didymodontis,* annulo simplici latiusculo.

Didymodon duriusculus, *Wils. l. c.* p. 299.

Hab. In Ceylon, *Gardner.*

Habitu facieque *T. tortuosæ* similis, sed paululum minor, pagina foliorum sæpe destructa, unde primo visu folia angustissima setacea apparent. *T. Bombayensi* etiam simillima, foliis autem cellulis minoribus firmioribus.

4. T. Bombayensis. (Trichostomum, *C. Müller, Syn.* ii. p. 628.)

Hab. Bombay, *Kegel*!

5. T. ANGUSTATA. Dioica, cæspitosa, lutea, caule elongato elato flexuoso dichotomo, foliis e basi erecta quadrata superne dilatata caulem amplexante squarroso-recurvis subulatis tenuiter angustatis longiusculis, nervo crasso luteo excurrente carinatis marginibus integerrimis, cellulis basi elongatis parallelogrammaticis pellucidis sensim in parvas obscuras fere læves transeuntibus.

Hab. In Ceylon, *Gardner*! (No. 134).

T. duriusculæ similis, sed foliis siccitate minus incurvo-crispatis angustioribus et basi amplexante statim dignoscitur.

6. T. anomala. (Barbula, *Bryol. Europ.*)

Hab. In Himalaya boreali-occident., *Royle*! et in reg. temp., *T. Thomson* (No. 138, 139, 140, 141, 142, 183). Kumaon, *Strachey et Winterbottom*!

Forsan a *Trichostomo corniculato*, Schw. t. 118, non diversa.

7. T. longifolia. (Barbula, *Griff. Not.* p. 410; *Icon. Plant. Asiat.* ii. t. lxxix. f. 11.)

Hab. In mont. Khasia, ad Moflong et Bogapanee, *McClelland.*

Ex icone *T. cylindricæ* affinis.

8. T. cylindrica. (Weissia, *Bruch in Bryol. Germ.*—Trichostomum, *C. Müller, Syn.* i. p. 586.—Didymodon longifolius, *Griff. Not.* p. 433; *Icon. Plant. Asiat.* ii. t. lxxx. f. iv.)

Hab. In Himalayæ reg. temp., Nepal. *Wallich! et J. D. Hooker* (No. 136 *c*). Sikkim, *J. D. Hooker*! (No. 115, 149). In Ceylon, *Gardner*! in mont. Khasia., "Ripæ Surureem," *Griffith*!

9. T. orthodonta, *C. Müller, Bot. Zeit.* 1853, p. 57.

Hab. In mont. Nilghiri, *Schmid*! *Gough*! In Ceylon ins., *Walker*!

10. T. STENOPHYLLA (*Mitten*). Dioica, cæspitosa, flavescens, caule innovationibus ramoso gracili humili, foliis e basi erecta patentibus incurvis siccitate cirrhatis lineari-lanceolatis tenuiter angustatis fragillimis, nervo luteo percurrente carinatis marginibus ob papillas prominulas crenulatis, cellulis basi elongatis pellucidis parallelogrammaticis superne rotundatis minute papillosis, perichætialibus caulinis similibus,

theca in pedunculo pallido luteo cylindrica erecta leptodermi ætate valde plicata, operculo conico subulato thecam dimidiam æquante, peristomii dentibus brevibus aurantiacis structura iis *T. cylindricæ* similibus, annulo nullo.

Hab. In Himalayæ orient. reg. alp., Sikkim in arborum cortice, *J. D. Hooker*! (No. 159). In mont. Nilghiri, *Foulkes*!

T. orthodontæ affinis, sed minor, foliis magis crispatis fragilibus, cellulis minus opacis et theca leptodermi. A *T. cylindrica* foliis angustioribus basi erectis cauli appressis pallidis et statura minore differt.

11. T. Khasiana (*Mitten*). Caule erecto, foliis patentibus siccitate tortis e basi suborbiculari erecta subito subulato- longe lineari-lanceolatis acutis nervo crassiusculo excurrente carinatis cellulis basi pellucidis luteis parallelogrammaticis superioribus minoribus subobscuris papillosis.

Hab. In mont. Khasia, reg. subtrop., inter *Plagiochasma cordatum*, *J. D. Hooker et T. Thomson*!

T. orthodontæ similis, tamen foliis tortis non incurvis nec crispatis et basi latiore suborbiculari diversa. Color in foliis superioribus luteus, in senioribus nigrescens.

12. T. amplexifolia. Dioica, cæspitosa, caule humili simpliciusculo, foliis e basi erecta appressa superne dilatata caulem amplexante sensim lanceolatis patentibus paululum recurvis, apice obtusiusculo nervo flavo excurrente mucronatis carinatis marginibus integerrimis nullibi recurvis, cellulis basi pellucidis oblongis parallelogrammaticis sensim in minutas quadrato-rotundatas obscuras vix distinctas transeuntibus, perichætialibus late lanceolatis erectioribus inferne laxioribus amplexantibus superne acutioribus, theca in pedunculo aurantiaco erecta ovali-cylindrica, peristomio longiusculo rubro torto.

Hab. In Himalayæ occident. reg. temp., Kumaon., *Strachey et Winterbottom*!

T. unguiculatæ primo adspectu omnino similis, foliis autem e basi caulem amplexante et marginibus non recurvis statim dignoscitur. Cellulæ foliorum iis *T. ungulatæ* paululum minores et obscuriores sunt.

13. T. flavescens, *Hook. et Grev.*

Hab. In Nepal. *Wallich*!

T. unguiculatæ maxime similis, sed folia basi latiora. A *Barbula fallaci* longe aliena et in temporibus nostris ad eam non comparanda.

14. T. gregaria (*Mitten*). Dioica, cæspitosa, humilis, caule subsimplici sordide viridi lutescente inferne fuscescente, foliis erecto-patentibus siccitate tortis spiraliterque cauli incurvatis late ovato-lanceolatis obtusis apice subcucullatis nervo crasso luteo apice dorso paulisper scabro carinatis et in apiculum brevem excurrente marginibus integerrimis inferne recurvis, cellulis baseos in folio medio ad nervum paucis elongatis luteis pellucidis reliquis parvis quadrato-rotundis subobscuris

utrinque papillosis, perichætialibus erectis basi oblongis convolutis apice acuminatis, theca in pedunculo intense rubro cylindrica erecta, operculo subæquilongo, peristomio operculi longitudinis rubro.

T. apiculata, *Wils. l. c.* p. 322.—Trichostomum brachyphyllum, *ejusd. l. c.* p. 321.

Hab. In Nepaliæ orient. reg. temp., *J. D. Hooker*! (No. 166). In Tibetiæ reg. temp., *T. Thomson*! (No. 126).

T. unguiculatæ, formæque ejus *T. apiculatæ*, habitu facieque persimillima, sed structura foliorum supra memorata certe diversa. A *T. flavescente* foliis latioribus, marginibus non reflexis, cellulis obscurioribus et perichætialibus latioribus satis diversa videtur.

15. T. indica, *Hook. Musc. Exot.* t. 135.

Hab. In Nepal. *Wallich*! Ad Madraspatanam, *Wight*! In Ceylon, "Ripæ prope Jumalpore Bengaliæ inferioris," *Griffith* (No. 162).

Hujus speciei ex herb. Willdenow specimen sub nomine *Trichostomi orientalis* accepit cl. Hooker!

16. T. angustifolia, *Hook. et Grev., Brewster's Edinb. Journ.* i. p. 299, t. 12.

Hab. In Nepal. *Wallich*!

Species ut videtur a *T. indica* foliis angustioribus et theca firmiore diversa. Nervum folii dorso eodem modo aspero ut in *T. indica.*

17. T. cylindrotheca. Dioica, cæspitosa, luteo-viridis, caule dichotomo breviusculo, foliis e basi brevi erecta late lanceolatis acuminatis, nervo concolori in mucronem excurrente, marginibus integerrimis, cellulis a basi in partem erectam laxis pellucidis parallelogrammaticis sensim in minutas obscuras virides transeuntibus, perichætialibus conformibus, theca in pedunculo breviusculo cylindrica longiuscula erecta arcuatave, collo sensim attenuato.

Trichostomum Bombayense, *Wils. l. c.* p. 322.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. H.*! (No. 164 *b*).

Habitus *T. Northianæ*, sed minor.

3. Anœctangium, *Hedw.*

1. A. Roylei (*Mitten*). Dioicum, cæspitosum, læte virens, foliis patentibus lineari-lanceolatis sensim acutis basi vix dilatatis nervo crassiusculo dorso lævi excurrente carinatis, cellulis superioribus parvis rotundatis inferioribus basin versus in folio medio ad nervum elongatis oblongis omnibus distinctis lævibus pellucidis, perichætialibus parvis orbiculari-ovatis acuminatis, theca in pedunculo breviusculo obovata, operculo subulato theca breviore.

Hab. In Himalaya boreali-occident., *Royle*!

Caulis vix uncialis fastigiatim ramosus; foliis statu sicco compacte incurvis interdum uno latere dejectis læte viridibus, inferioribus pallide

fuscis. *A. Hornschuchiano* ob folia densiora paululum crassiora, et primo adspectu *Hymenostylio xanthocarpo* simillimum.

2. A. CLARUM (*Mitten*). Dioicum, cæspitosum, læte virens, subluteum, inferne fuscescens, caule dichotomo, foliis erecto-patentibus lanceolatis acutis nervo concolori carinatis integerrimis, cellulis minutis rotundatis omnibus distinctis lævibus, perichætialibus imbricatis ovatis acuminatis, theca in pedunculo gracili ovali erecta, operculo planiusculo rostro tenui capsulam dimidiam longitudine æquante.

A. compactum, var. *Wils. l. c.* p. 326.

Hab. Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 202, 203).

Facies primo visu omnino *A. compacti*, foliis tamen pagina ubique pellucida molliore facile cernibile.

3. A. THOMSONI (*Mitten*). Dioicum, cæspitosum, viride, lutescens, caule dichotomo, foliis siccitate crispatis humidis patentibus e basi angustiore vel interdum latiore ovata lanceolatis acutis nervo concolori carinatis integerrimis, cellulis basi oblongo-ovalibus sensim in minutas rotundatas superne obscuras papillosas transeuntibus, perichætialibus elliptico-oblongis acuminatis imbricatis, theca in pedunculo mediocri ovali erecta, ore amplo.

A. crispulum, *Wils. l. c.* p. 325. Tortula allied to T. paludosa *ejusd. l. c.* p. 322.

Hab. In Himalayæ reg. temp., Sikkim, *J. D. Hooker*! (No. 197, 200, 201, 205); *Royle*! *T. Thomson* (No. 153, 156, 199). Kumaon, *Strachey et Winterbottom*!

Ab *A. compacto* statura paululum robustiore foliis longioribus tortuosis et structura recedit.

4. A. STRACHEYANUM (*Mitten*). Dioicum, cæspitosum, luteum, fuscescens, caule gracili dichotomo, foliis patentibus incurvis lanceolatis acutis nervo concolori dorso papillis eroso-carinatis integerrimis, cellulis minutis vix papillosis subobscuris, perichætialibus imbricatis ovatis acuminatis, theca in pedunculo gracili ovali, operculo subulato æquilongo.—A. tortifolium, *Wils. l. c.* p. 326.

Hab. In Himalayæ boreali-occident. reg. temp., *T. Thomson* (No. 207). Kumaon, *Strachey et Winterbottom*!

A. compacto minus, foliis dimidio angustioribus siccitate subspiraliter tortis, cellulis superioribus minus obscuris et nervo dorso asperulo.

5. A. CRASSINERVIUM (*Mitten*). Cæspitosum, humile, viride, caule dichotomo, foliis patentibus apice patulo-recurvis ovato-lanceolatis obtusis nervo crassiusculo carinatis integerrimis, cellulis basi majoribus parallelogrammaticis superioribus minutis subobscuris, perichætialibus imbricatis ovatis.

A. pusillum, *Wils. l. c.* p. 325.

Hab. In Tibet occid. reg. temp., *T. Thomson*! (No. 127).

A reliquis speciebus indicis foliis obtusis nervo crasso carinatis facile cernendum. A *Zygodonte* (*Anœctangio*) *pusillo* C. Mülleri longe diversum.

6. A. Schmidii, *C. Müller, Bot. Zeit.* 1853, p. 60.
Hab. In mont. Nilghiri, *Schmid.*
E. descriptione potius ad *Didymodontes* pertinere videtur.

4. Hymenostylium, *Brid.*

Gymnostomum ex parte, *Hedw. et auct.*; Gymnostomum et Eucladium, *Br. & Sch. Bryol. Europ.*; Pottia ex parte, *C. Müller, Synops.*

1. H. xanthocarpum, *Brid.* (Gymnostomum, *Hook. Musc. Exot.* t. 153.)
Hab. In Nepal. *Gardner* !

2. H. aurantiacum (*Mitten*). Dioicum, cæspitosum, caule dichotomo, foliis patentibus lanceolatis acutis nervo dorso papilloso excurrente carinatis integerrimis, cellulis baseos oblongis sensim in minutas rotundatas transeuntibus, perichætialibus longioribus, theca in pedunculo luteo aurantiaca globoso-ovata, operculo subulato theca longiore.
Gymnostomum xanthocarpum, *Wils. l. c.* p. 291.
Hab. In Himalayæ reg. temp., Sikkim, *J. D. Hooker* ! (No. 190). In Kumaon, *Strachey et Winterbottom.* In Tibet occid. reg. temp., *T. Thomson* ! (No. 126*b*, 127 *b*, 132, 188.)
Habitus *H. xanthocarpi*, sed paululum gracilius, foliis dimidio augustioribus, cellulis basi oblongis vix parallelogrammaticis, nervo dorso minute papilloso scabro et operculo longiore diversum videtur. Ab *H. curvirostro* foliis magis linearibus apice subacutatis recedit.

3. H. commutatum (*Mitten*). Dioicum, habitu *H. curvirostri*, foliis e basi suboblonga lanceolatis angustatis nervo sub apice evanido carinatis, cellulis fere omnibus elongatis pellucidis, perichætialibus conformibus, theca *H. curvirostri*.
Hab. In Himalaya boreali-occident., *Royle* ! In Tibet occid. reg. temp., in valle fluvii Indus, *T. Thomson* ! (No. 128, 130). Etiam in Helvetia, *Schleicher* ! et in Britannia.
Species quamvis forma cellularum in folii parte superiore elongata non rotundata satis facile ab *H. curvirostro* cernenda, et verisimiliter ad speciem inter illas ab Hornschuchio descriptas propius referenda, tamen foliorum structura non descripta, distinctionem veram frustra quæsivi.

4. H. curvirostrum. (Gymnostomum, *Hedw., Br. & Sch., Bryol. Europ.* t. vii !—G. atroviride, *Griff. Not.* p. 393; *Icon. Plant. Asiat.* ii. t. xcv. f. 1.)
Hab. In Himalayæ reg. temperata, *Wallich* ! *et Royle* ! Kurmaon, *Strachey et Winterbottom* ! In Tibet occid. reg. temp. et alp., *T. Thomson* ! (No. 129, 131, 133). In mont. Khasian. ad rupes madidas ad Moosmai, *Griffith* !

5. H. calcareum. (Gymnostomum, *Hsch.*).
Hab. In Tibet occid. reg. temp. ad Rondu inter cæspites *Tortulæ anomalæ, T. Thomson* !

6. H. vernicosum. (Gymnostomum, *Hook.*)
Hab. In Nepal, *Wallich* !

? 7. H. inconspicuum, *Griff. Not.* p. 394.
Hab. In mont. Khasian. in rupibus madidis cum *Dicranis* quibusdam, *Griffith*.
Species forsan hujus generis mihi non visa.

5. Barbula, *Hedw.*, ex parte.

Tortula, Trichostomum, Didymodon et Gymnostomum ex parte, *auctorum*.
Folia rubiginosa vel fusca.

1. B. rufescens. (Gymnostomum, *Hook. Icon. Plant. Rar.* t. 17.—G. recurvum, *Griff. Not.* p. 397; *Icon. Plant. Asiat.* ii. t. xcii. f. 2. —Grimmia? remota, *Wils. l. c.* p. 323.)
Hab. In Himalayæ reg. temp., Nepal, *Wallich* ! Sikkim, *J. D. Hooker* (No. 176, 178). In mont. Khasian. reg. temp. *J. D. H. et T. T.* ! (No. 163, 264, 265); et ad Boga Panee, *Griffith* !
Icon in 'Icon. Plant. Rar.' Hookeri ad naturam quoad sectionem transversalem et areolationem vix quadrat. Species omnino ad hunc locum pertinens et *B. gracili* affinibusque simillima.

2. B. vinealis, *Brid.* (Tortula vinealis var.? *Wils. l. c.* p. 322.)
Hab. In Nepal, *Wallich*. Kumaon reg. temp., *T. Thomson* ! (No. 173).

3. B. obscura (*Mitten*). Dioica, cæspitosa, caule elongato innovando ramoso, foliis e basi subquadrata superne paululum dilatata erecta cauli appressa patentibus lanceolatis strictis nervo crassiusculo excurrente carinatis marginibus e basi ad medium reflexis, cellulis basi pellucidis elongatis parallelogrammaticis superne sensim in minutas obscuras papillosas transeuntibus, perichætialibus e basi late ovali vaginante subulato-lanceolatis longiusculis, theca in pedunculo rubro cylindrica.
Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* !
B. fallax et *B. vinealis* colore statura habituque valde affines, sed structura folii baseos certe alienæ.

4. B. constricta (*Mitten*). Dioica, cæspitosa, caule elongato geniculato innovando ramoso, foliis laxis patentibus e basi ad insertionem constricta subovata concava sensim lanceolato-angustatis nervo crassiusculo fusco excurrente carinatis margine a basi ad medium recurvo, cellulis inferne rotundato-quadratis pellucidis superne in minores subobscuras transeuntibus, perichætialibus erecto-patentibus e basi

lata subovata amplexante sensim attenuatis, theca in pedunculo rubro cylindrica subovata, peristomio rubro.

Tortula vinealis, var., *Wils. l. c.* p. 322.

Hab. In Himalayæ orient. reg. temp. et alp., Sikkim et Nepal, *J. D. Hooker* (No. 170).

Species formis gracilioribus *B. fallacis* et *B. vinealis* oculo nudo omnibus partibus conveniens, sed foliis basi infima constrictis, cellulis ob latitudinem parietum distinctioribus.

5. B. HASTATA (*Mitten*). Dioica, cæspitosa, caule innovationibus gracilibus brevifoliosis flagelliformibus ramosis, foliis patentibus patulisque inferioribus ramisque hastatis superioribus ovatis acuminatis ovato-lanceolatisque nervo crassiusculo fusco excurrente carinatis margine fere ad apicem reflexo, cellulis parvis rotundatis subobscuris conformibus, perichætialibus erectis oblongo-ovatis convolutaceis brevi-apiculatis, theca in pedunculo pro planta crassiusculo intense fusco ovali erecta, peristomio dentibus rubris ad basin liberis tortis.

Tortula comosa? *Wils. l. c.* p. 322.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 185).

Habitu coloreque formis gracilioribus *B. fallacis* similis, foliis autem perichætialibus brevi-apiculatis erectis diversa.

6. B. RECURVIFOLIA (*Mitten*). Cæspitosa, rubiginosa, caule elongato sæpe elato ramoso, foliis patulis recurvis e basi ovata sensim lanceolatis apice sæpe hyalinis nervo fusco percurrente carinatis dorso minute tuberculoso marginibus basi ad medium reflexis integerrimis, cellulis basi oblongis parvis superne minutis rotundatis distinctis fere lævibus.

Tortula fallax *et* Schistidium apocarpum, *Wils. l. c.* p. 322, 323.

Hab. In Tibet. occid. reg. alp., ad summitatem montis Hera La, alt. 18,700 ped., *Strachey*! et inter specimina *Cetrariæ nivalis*, alt. 10,000–12,000 ped., reg. temp., *T. Thomson*! (No. 143). In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 168). Etiam in alpinis montium Pyrenæorum, *Spruce* (*Musc. Pyren.* No. 185) (Tort. vinealis, var. nivalis); et in Hibernia, *Moore*!

A *B. vineali* foliis magnopere recurvis, apicibus latioribus hyalinis, et nervo angustiore dorsoque tuberculis scabro, præterea statura altiore refugiens.

7. B. ASPERIFOLIA (*Mitten*). Rubiginosa, caule ramoso, foliis patentibus recurvis e basi oblongo-ovali lanceolatis acutis nervo fusco percurrente dorso ob papillas grossas scabro carinatis margine integerrimo fere toto reflexo, cellulis basi elongatis parallelogrammaticis superne parvis rotundatis ubique papillis grossiusculis asperis.

Hab. In Himalayæ orient. reg. alp., Sikkim, inter cæspites *Oreadis Martianæ*, *J. D. Hooker*!

Caulis uncialis ferrugineo-fuscus. *Folia* siccitate incurva appressa, humida recurva. *B. fallaci* et *B. vineali* similis, sed foliis basi magis ovalibus grosse papillosis facile distinguenda.

8. B. ALBICUSPIS (*Mitten*). Intense rubiginosa, caule erecto ramoso, foliis patentibus recurvis e basi oblongo-ovali lanceolatis apicibus hyalinis argute denticulatis nervo fusco dorso minute scabro percurrente carinatis marginibus totis fere reflexis apice excepto integerrimis, cellulis basi parvis oblongo-rotundatis superne minutis fere lævibus.

Hab. In Himalayæ orient. reg. alp., Sikkim, ad Donkia Pass, alt. 18,000 ped., *J. D. Hooker!*

B. asperifoliæ habitu magnitudine et colore similis, foliis autem apiculo hyalino argute serrulato et cellulis ad folii basin minoribus certe recedit.

9. B. SUBPELLUCIDA (*Mitten*). Dioica, cæspitosa, caule elongato simplici, foliis erecto-patentibus lanceolatis incurvis strictisve concavis, apice in inferioribus obtusiusculo subcucullato, in superioribus acutis, nervo concolori ætate fusco dorso scabro sub summo apice evanido carinatis, marginibus recurvis apice nonnunquam suberosis, cellulis superioribus rotundatis parvis basi elongatis parallelogrammaticis omnibus distinctis subpellucide viridibus, perichætialibus conformibus, theca in pedunculo elongato flavo ovali-cylindrica, operculo subulato theca breviore, peristomio elongato rubro torto.

Hab. In Himalaya boreali-occident., *Royle!* In Tibet. occid. reg. temp., *T. Thomson!* (No. 121).

Caulis uncialis biuncialisve, formis robustioribus *B. fallacis* similis. *Folia* viridia.

10. B. tophacea, *Mitt.* (Trichostomum, *Bridel.*—Ceratodon purpureus vel C. stenocarpus, *Wils. l. c.* p. 299.)

Hab. In Tibet. occid. reg. temp., *T. Thomson!* (No. 101, 155).

11. B. comosa, *Dozy et Molk. Musci. Archip. Ind.* fasc. ii. t. xvii. (Trichostomum tortile, *Wils. l. c.* p. 321.—B. arcuata, *Griff. Not.* p. 411; *Icon. Plant. Asiat.* ii. t. lxxix. f. 1.)

Hab. In Himalayæ reg. temp., Nepal, *Wallich!* Sikkim, *J. D. Hooker!* (No. 165). Ad Singapore, et in mont. Khasian. ad Boga Panee, *Griffith.*

12. B. GRACILENTA (*Mitten*). Dioica, cæspitosa, caule innovationibus ramoso gracili humili, foliis patentibus e basi hastata lanceolatis iis caulis sterilis ovatis apice latiusculis obtusiusculis acutatis nervo excurrente carinatis margine a basi ad medium reflexo, cellulis parvis omnibus conformibus distinctis, perichætialibus erectis e basi latiore elongata amplexante lanceolatis, theca in pedunculo gracili ovali.

Tortula flavescens, var., *Wils. l. c.* p. 322.

Hab. In Himalayæ boreali-occident. reg. temp., *T. Thomson!* (No. 189).

Stirps parva gracilis *B. comosa* gracilior, foliis brevioribus et in ramis non fructificantibus obtusiusculis. *Color* subluteus. A *T. flavescente* foliis in caule fertili a basi lata sensim angustatis haud obtusatis differt.

13. B. OVATA (*Mitten*). Dioica, cæspitosa, caule innovationibus ramoso, foliis inferioribus pallidis superioribus ferrugineis patentibus incurvis ovatis acutis apiculove obtusiusculo terminatis marginibus recurvis, nervo tenui in apiculum excurrente, cellulis quadratis conformibus minute papillosis.

Hab. In Himalayæ orient. reg. alp., Sikkim, *J. D. Hooker*! (No. 184).

A *B. trifaria* (*Trichostomum* auctorum) statura conveniente et forma foliorum subsimili, foliis magis incurvis apiculo parvo obtuso et areolatione diversa.

14. B. NIGRESCENS (*Mitten*). Dioica, cæspitosa, humilis, lutea, mox nigrescens, caule innovando ramoso, foliis patentibus ovatis apicibus obtusiusculis paululum incurvis nervo fusco in apicem evanido carinatis margine inferne reflexo superne fere ad apicem recurvo, cellulis minutis subobscuris conformibus, perichætialibus longioribus erectis ovato-lanceolatis, theca in pedunculo intense aurantiaco-fusco cylindracea, operculo subulato thecam dimidiam longitudine æquante, peristomio dentibus ad basin discretis aurantiacis, annulo latiusculo.

Tortula fallax, *Wils. l. c.* p. 322.

Hab. In Himalayæ reg. temp., Sikkim, *J. D. Hooker*! (No. 169). Kumaon, *Strachey et Winterbottom*!

Primo adspectu *Tortulæ unguiculatæ* similis, sed structura formaque foliorum *B. fallaci* et ejus affinibus consocianda, a quibus foliorum apicibus obtusiusculis annuloque recedit.

15. B. CONFERTIFOLIA (*Mitten*). Humilis, cæspitosa, fusca, caule simplici, foliis patentibus ovatis obtusis, nervo crasso fusco sub summo apice evanido, margine ubique reflexo, cellulis basi parvis quadratis subpellucidis superioribus minoribus obscuris minute papillosis.

Hab. In Nepal (*Bryo Weisiæ* consociata), *Wallich*!

B. Schimperi (*Trichostomum*, Mont.) affinis, et, nisi statura paululum robustiore et areolatione in folii parte superiore obscuriore, vix distinguenda. *Folia* siccitate minus torta.

6. DESMATODON, *Brid.*, ex parte.

Gymnostomum ex parte, Pottia, Hyophila, Trichostomum ex parte, Tortula et Barbula ex parte, *auct.*

Peristomium hujus gregis statu perfecte evoluto a *Syntrichia* non recedit, habitus autem et forma et structura foliorum in illam vix transitionem directam indicant.—Peristomium *Pottiarum* ut in *P. cavifolia* et in *P. minutula* invenitur, cujus formæ peristomatæ a bryologis vel pro *Anacalypta* vel pro *Desmatodonte* nuncupantur, inter quas tamen nulla distinctio adesse videtur in speciminibus pluribus in pluribus statibus observatis; quare gradus peristomii evolutionis nec pro distinctione generica neque pro discrimine tuto specifico servandus putetur. Observationis dignum est quod cellulæ operculorum specierum eperisto-

matarum ut plurimum spiraliter dispositæ sunt, unde si peristomium adfuerit, necesse est ut torqueretur.

1. D. inermis. (Tortula, *Mont.*)
Hab. In Tibet. occid. reg. temp., *T. Thomson*! (No. 175 *a, b, c*).

2. D. mucronifolius. (Barbula, *Schw.* t. 34.—Tortula rosulata, *Wils. l. c.* p. 322.)
Hab. In Tibet. occid. reg. alp., *T. Thomson*! (No. 257) (*Hypno glaciali* consociatus).

3. D. latifolius, *Brid.*
Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 117, 119).

4. D. Laureri, *Bryol. Europ.*
Hab. In Tibet. occid. reg. temp. et alp., *T. Thomson*! (No. 278). In Himalaya occidentali, Kumaon, *Strachey et Winterbottom*!

5. D. cernuus, *Hüb.*
Hab. In Tibet. occid. reg. alp., *T. Thomson*! (No. 186).

6. D. LONGIROSTRIS (*Mitten.*—Gymnostomum, Hymenostylium longirostrum, *Griff. Not.* p. 395; *Icon. Plant. Asiat.* ii. t. xcv. f. iii.). Caule simplici humili gracili, foliis laxis patentibus inferioribus e basi oblonga erecta ligulari late lanceolatis acutis superioribus acuminatis nervo excurrente mucronatis marginibus undulato-incurvis integerrimis, cellulis in parte erecta elongatis pellucidis superioribus parvis subobscuris luteo-viridibus sublævibus, perichætialibus conformibus, theca in pedunculo brevi gracillimo pallido ovali macrostoma leptodermi, operculo subulato longe rostrato.
Hab. In mont. Khasian., ad lignum putridum, *Griffith*!
Caulis semuncialis. *Folia* circiter linearia siccatione incurva crispataque. *Pedunculus* bilinearis gracillimus. *Theca* parva pallide fusca, ore intensiore colorato.
Species distinctissima, cujus specimina paucissima vidi. Ab *Hymenostyliis* valde diversum.

7. D. RECURVUS (*Mitten*). Dioicus? cæspitosus, fuscescens, caule elongato subsimplici, foliis patentibus inferioribus spathulatis obtusiusculis serrulatis superioribus lineari- late lanceolatis acuminatis subintegerrimis integerrimisve nervo fusco in cuspidem excurrente leviter carinatis, marginibus apice incurvis, cellulis in basi erecta media ad nervum tenerrimis hyalinis fugacibus elongato-oblongis sensim in minores quadrato-rotundatas distinctas papillosas transeuntibus, theca in pedunculo breviusculo rubescente ovali-cylindrica erecta, operculo subulato recto obliquove obtuso theca subtriplo breviore.
Gymnostomum recurvum, *Griff. Not.* p. 397; *Icon. Plant. Asiat.* ii.

t. xcii. f. 11; errore typographico *G. longirostro* ad pedem tabulæ adscriptum.—Tortula cacuminata, *Wils. l. c.* p. 322.

Hab. In Himalayæ reg. temp., Sikkim, *J. D. Hooker*!

Species distinctissima, cujus caules steriles tantum vidi, altitudinis semi-sesquiuncialis, statu sicco foliis laxe appressis nec tortis nec incurvis, ochraceo-fuscis. Specimina Griffithiana non examinavi; sed icon et descriptio satis conveniunt.

8. D. Wallichii (*Mitten*). Dioicus, cæspitosus, rubiginosus, caule brevi elongatove sæpe innovante, foliis patentibus ovato-lanceolatis elongatisve acutis nervo in mucronem excurrente carinatis, margine a basi ad medium reflexo apicem versus argute serrato, cellulis basi elongatis pellucidis superne minutis obscuris papillosis, perichætialibus e basi ovali angustatis lanceolatis apice serratis, theca in pedunculo gracili erecta cylindrica subinæquali, operculo conico subulato thecæ tertiam partem longitudine æquante, peristomio brevi vix torto dentibus ad basin liberis, annulo simplici.

Trichostomum dentatum, ex parte, *Wils. l. c.* p. 299.

Hab. In Himalayæ reg. temp., Sikkim, *J. D. Hooker*! (No. 167). In Nepal, *Wallich*! Himalaya boreali-occident., *T. Thomson*! (No. 137). Kumaon, *Strachey et Winterbottom*!

D. serrulato (*Tortula*, Hook. et Grev.) affinis, foliis autem superne latioribus et peristomio longe diverso.

9. D. limbatus (*Mitten*). Dioicus, caule brevi, foliis in comam congestis ovato-elongatis obtusiusculis, nervo fusco in mucronem hyalinum excurrente, margine ad apicem reflexo, cellulis basi laxis pellucidis superne minutis opacis sed ad marginem reflexum margineque ipso pellucidioribus papillosis, perichætialibus conformibus, theca in pedunculo flavo cylindrica.

Hab. In Tibet. occid. reg. temp., ad vallem Parang, alt. 10,000 ped., *T. Thomson*!

Species *D. marginato* (*Barbula*, B. & S.) magnitudine habituque similis, sed ab eo et affinibus foliorum cellulis ad marginem pallidioribus chlorophyllo destitutis, unde folium linea pallida intra marginem exaratum esse videtur, diversa. Specimina paucissima vidi.

10. D. chloronotos. (Barbula, *Brid.*—B. arenaria, *Griff. Not.* p. 409; *Icon. Plant. Asiat.* ii. t. ciii. f. 1.)

Hab. In Affghanistan, *Griffith*.

Hanc speciem non vidi, sed ex icone a specie europæa meridionali non diversa videtur.

11. D. rigidus. (Barbula, *Schultz*.)

Hab. In Tibet. occid. reg. temp., *T. Thomson* (No. 268).

12. D. Javanicus. (Barbula.)

Hab. In Himalaya centrali tropica? Nepal, *Wallich*! *J. D. Hooker*! In Ceylon, *Gardner* (No. 160).

13. D. spathulatus. (Gymnostomum, *Harvey*; *Hook. Icon. Plant. Rar.* t. 7.)

Hab. In Nepal, *Wallich*!

14. D. involutus. (Gymnostomum, *Hook. Musc. Exot.* t. 154.)

Hab. In Nepal, *Gardner*! *et Wallich*! In Himalaya boreali-occident., *Royle*!

7. Syntrichia, *Brid.*

1. S. Schmidii, *C. Müller, Bot. Zeit.* 1853, p. 58.

Hab. In mont. Nilghiri ad arborum truncos, *Gough*! *Perrottet*! *Schmid*!

2. S. princeps. (Tortula, *De Notaris.*—Tortula lævipila, var. vel sp. aff., *Wils. l. c.* p. 323.)

Hab. In Himalayæ orient. reg. alp., Sikkim, *J. D. Hooker* (No. 172).

3. S. ruralis, *Brid.*

Hab. In Tibet. occid. reg. alp. ad Sassar Pass, alt. 16,000–17,000 ped., *T. Thomson*! et in cacumine montis Hera La, alt. 18,000 ped., *Strachey*! etiam in reg. temp. ad Rondu, *T. Thomson*!

Fragmenta tantum, sed a planta europæa non diversa.

4. S. caninervis (*Mitten*). Dioica? cæspitosa, caule breviusculo dichotomo, foliis patentibus ovatis apice obtusis nervo crassiusculo longe excurrente concolori dorso apiceque hyalino scabris, marginibus ubique recurvis integerrimis, cellulis in folii medio inferne tenerrimis hyalinis superne minutis obscuris minutissime papillosis sublævibus, perichætialibus erectioribus marginibus minus recurvis, theca in pedunculo flavo.

Tortula ruralis, var., *Wils. l. c.* p. 322.

Hab. In Tibet. occid. reg. temp., ad rupes? *T. Thomson*! (No. 174).

Formis minoribus *S. lævipilæ* primo adspectu similis, sed foliis ovatis, nervo crasso longe excurrente, et marginibus ubique recurvis.

8. Syrrhopodon, *Hook. et Grev.*

* *Orthophyllum.*

1. S. rufescens, *Hook et Grev.* (S. revolutus, *Dozy et Molk. Musc. Archip. Ind.* t. 22, e speciminibus auctorum.)

Hab. In Singapore, *Wallich*! Etiam in Java, *Dozy*! et Labuan, *Motley*!

** *Eusyrrhopodon.*

2. S. spiculosus (*Hook. et Grev. in Brewst. Edinb. Journ.* v. 3. —S. microphyllus). Dioicus, cæspitosus, caule dichotomo, foliis patentibus siccitate vix mutatis, e basi elliptica utrinque margine spinoso circiter sex-ciliato linearibus obtusis, nervo dorso æque ac pagina spiculis parvis asperrimo, marginibus incurvis minute dense eroso-serrulatis, cellulis calymperoideis in formam ellipticam aggre-

gatis basin totam tertiamque folii longitudinis partem occupantibus, superne minutis obscuris papillosis, perichætialibus conformibus, theca in pedunculo gracili rubro cylindracea collo attenuato, peristomio parvo generis.

Hab. In Singapore, *Wallich*! Etiam in Labuan, *Motley*!

S. Leprieurii forma et ciliatione foliorum similis, sed minor, foliis basi angustioribus, cellulis calymperoideis minoribus, superne spiculis copiosioribus majoribus vestito. Species hodie a *S. rufescente*, quocum ab auctoribus comparata fuit, longe separanda.

3. S. Griffithii (*Mitten*). Dioicus, parvulus, caule brevi, foliis patentibus inferioribus late lineari-lanceolatis acutis superioribus e basi latiore lanceolatis obtusiusculis, nervo tenui dorso apice spiculoso, marginibus integerrimis tenuiter limbatis incurvis, cellulis calymperoideis in formam ovatam acutam dispositis $\frac{3}{7}$ folii longitudinis æquantibus superioribus minutis obscuris dorso grossiuscule papillosis, perichætialibus conformibus, theca in pedunculo gracili ovali.

Hab. Singapore, *Griffith*!

Species a congeneribus statura parvula magnitudine *Pottiæ minutulæ* non dissimili et colore fusco recedens. A *S. trachyphyllo*, quocum papillis foliorum convenit, foliis basi non spinoso-ciliatis diversus. Thecam unam tantum vidi.

4. S. heterophyllus (*Mitten*). Cæspitosus, caule elongato, foliis e basi erecta superne paululum dilatata linearibus lanceolatisve obtusis acutisve, nervo crassiusculo excurrente, marginibus tenuiter limbatis serrulatis subintegerrimisve, cellulis calymperoideis in formam ovatam apice retuso dispositis superioribus minutis subobscuris minutissime papillosis pallide viridibus.

Hab. In Nepal, *Wallich*! In Ceylon, *Gardner*! (No. 135).

S. fastigiato similis, sed foliis siccitate magis incurvis latioribus basi non serrulatis et margine folii ipso teneriore subintegerrimo.

5. S. tristrichus, *Nees ab E.*

Hab. In Ceylon, *Gardner*!

6. S. Gardneri, *Schw.* (Calymperes, *Hook. Musc. Exot.* t. 146.—Weissia Macclellandi, *Griff. Not.* p. 408; *Icon. Plant. Asiat.* ii. t. lxxviii. f. 4.)

Hab. In Nepal, *Gardner*! *et Wallich*! In Ceylon, *Gardner* (No. 181, 187). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! (No. 124); et ad Myrung, *McClelland*.

Specimina Griffithiana non vidi, sed neque in descriptione nec in icone distinctionem a *S. Gardneri* invenio.

7. S. trachyphyllus, *Mont. Sylloge*, p. 47.

Hab. Singapore, *Gaudichaud*! Etiam in insula Labuan, *Motley*!

S. spiculoso similis, sed foliis siccitate incurvis statim dignoscitur.

8. S. CROCEUS (*Mitten*). Caule cæspitoso dichotomo, foliis patentibus rigidis e basi elliptica haud limbato-lineari spathulatis obtusis, nervo rigido percurrente, marginibus crasse limbatis remote dentatis, cellulis calymperoideis in formam quadratam dispositis tertiam longitudinis baseos ellipticæ occupantibus superioribus (folii baseos) elongatis colore pulchre croceo suffusis, iis folii partis elongatæ parvis obscuris, margine ubi basis elliptica in folium transire et incrassare incipit dentibus brevibus aculeiformibus armato, perichætialibus conformibus, theca in pedunculo elongato ovali.

Hab. Singapore, *Wallich* ! Etiam in insula Labuan, *Motley* !

S. rigido, cujus *S. longisetaceus* C. Mülleri synonymon verum est, persimilis, sed rigidior, foliis basi elliptica haud superne dilatata vaginantibus integerrimis, et cellulis calymperoideis spatium minus occupantibus.

9. CALYMPERES, *Swartz.*

1. C. repens. (Syrrhopodon, *Harvey*; *Hook. Icon. Plant. Rar.* t. 22. f. 4.—Orthotrichum undulatum, *Hook. et Grev.* ex parte.)

Hab. In Penang, *Wallich* ! In Ceylon, *Thwaites* ! Etiam in Ternate insula et in Nova Hollandia, fide speciminum Dicksonianorum !

2. C. Moluccense, *Schw.* (C. fasciculatum, *Dozy et Molk Bryol. Javan.* t. xli.)

Hab. In Singapore, *Wallich* ! Etiam in Java, *Teysmann* ! Labuan, *Motley* ! Hong-Kong, *Bowring* ! et Rauwack, *Gaudichaud* !

3. C. fasciculatum. (Syrrhopodon, *Hook. et Grev. in Brewster's Edinb. Journ. of Sc.* iii. p. 225, cum icone ubi calyptra ad naturam delineata est non obstante observatione cl. *Mülleri, Synops.* i. p. 529.)

Hab. In Nepal, *Wallich* ! Etiam in Ternate, et Australia e speciminibus Dicksonianis ! in insula Pitcairn ! necnon in Chili, *Cuming* !

4. C. serratum, *A. Braun.* (C. lonchophyllum, *Schw.* var., *Wils. l. c.* p. 292.)

Hab. In Ceylon, *Gardner* (No. 235). Etiam in Java, *Junghuhn* ! in Labuan, *Motley* ! et in Hong-Kong, *Bowring* !

5. C. SEMILIBERUM. Dioicum, cæspitosum, humile, caule dichotomo, foliis squarrosis lineari-lanceolatis acutis obtusiusculisve, nervo percurrente, marginibus integerrimis incurvis, cellulis calymperoideis hyalinis in formam ovatam acutam totam fere folii basin occupantibus et tertiam folii partem longitudine adæquantibus, cellulis in parte superiore parvis rotundatis obscuris papillosis, perichætialibus conformibus, theca in pedunculo brevi cylindrica, operculo subito subulato capsulam longitudine dimidiam æquante, peristomio dentibus 16 brevibus pallidis linea media exaratis incurvis, calyptra superne scabra thecam ad collum obtegente et basi eam amplexante pluriesve fissa thecam semiliberam relinquente.

Hab. In peninsula Malayana, ad Tavoy, in arboribus, *Rev. D. Parish* !

C. Moluccensi gracilius et flaccidius. *Caulis* semuncialis. *Pedunculus* capsula duplo longior, foliis perichætialibus brevior. *Calyptra* quam in congeneribus brevior et intumescentia thecarum sæpe pluries fissa; igitur capsula semilibera videtur. *Peristomium* huic generi negatum in speciebus aliis nonnullis inveni, et, si capsulæ perfecte maturatæ caute exploratæ fuerint, in speciebus omnibus adesse credo.

6. C. Dozyanum. (C. Moluccense, *Dozy et Molk. Bryol. Javan.* p. 47, t. xxxvii.)

Hab. In India orient. (*ex Herb. Dickson*!).

7. C. Mülleri. (Calymperidium, *Dozy et Molk. Bryol. Javan.* p. 51, t. xlii.)

Hab. In Ceylon, *Thwaites*!

Fragmenta pauca huic vel speciei affini referenda.

10. Encalypta, *Schreb.*

1. E. vulgaris, *Hedw.*

Hab. In Tibet. occid. reg. temp., *T. Thomson*! (No. 249).

2. E. commutata, *Nees et Hsch.*

Hab. In Tibet. occid. reg. alp., *T. Thomson*! (No. 250 ex parte).

3. E. ciliata, *Hedw.*

Hab. In Himalayæ occidentalis regione temperata, Kumaon, *Strachey et Winterbottom*!

4. E. rhabdocarpa, *Schw.*

Hab. In Tibet. occid. reg. alp., *Strachey et Winterbottom.* Ad Sassar Pass, alt. 16,000–17,000 ped., *T. Thomson*!

5. E. Tibetana (*Mitten*). Monoica, pusilla, foliis ligulatis oblongisve obtusis, nervo percurrente, marginibus cellulis exstantibus crenulatis, cellulis inferioribus laxissimis superioribus obscuris, theca in pedunculo breviusculo ovato-cylindrica plicata, operculo subæquilongo, peristomio dentibus breviusculis perforatis, calyptra apice lævi.

Hab. In Tibet. occid. reg. alp., *T. Thomson*! (No. 250 ex parte).

Caulis linearis bilinearisve. *Pedunculus* bilinearis purpureus. *Folia* brevia lata comalia oblonga ad medium laxissime areolata.

De *Hymenostomo encalyptoidi* (Griff. Not. p. 398, et Icon. Plant. Asiat. ii. t. ciii. f. 11.), an species indica vel mera *Encalyptæ vulgaris* analysis sit, silente Griffithio nihil dicendum est.

§ IV. Grimmiaceæ.

Orthotrichaceæ ex parte, Ripariaceæ et Grimmiaceæ *Schimp. Coroll.*

1. Cinclidotus, *Beauv.*

1. C. fontinaloides, *Beauv.*

Hab. In Tibet. occid. reg. temp., *T. Thomson*! (No. 227).

2. Grimmia, *Ehrh.*

§ 1. *Schistidium.*

1. G. apocarpa, *Hedw.* var. stricta. (G. stricta, *Turn.*)
Hab. In Himalayæ reg. temp., Sikkim, *J. D. Hooker*! (No. 318). In Himalaya boreali-occident., *T. Thomson* (No. 286). In Kumaon, *Strachey et Winterbottom*!

2. G. anodon, *Bruch et Schimp.*
Hab. In Tibet. occid. reg. temp., *T. Thomson*! (No. 287, 288, 289, 290).

§ 2. *Eugrimmia.*

3. G. Tergestina, *Tommas.*
Hab. In Tibet. occid. reg. temp., *T. Thomson* (No. 281 et forsan No. 311).

4. G. leucophæa, *Grev.* (G. subfusca, *Wils. l. c.* p. 323.)
Hab. In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 296).

5. G. reduncA (*Mitten*; *Wils. l. c.* p. 323). Dioica? caule cæspitoso elongato ramoso gracili, foliis e basi erecta subelliptica patentibus lanceolatis nervo percurrente carinatis margine integerrimo recurvo, cellulis in basi media ad nervum elongatis angustis pellucidis marginalibus 4–5-seriatis pellucidis superioribus minutis subrotundis subobscuris, perichætialibus longioribus basi latioribus convolutaceis, theca in pedunculo brevi arcuato parva ovali lævi, operculo conico, peristomio dentibus brevibus.
Hab. In Himalayæ orient. reg. alp., Sikkim, *J. D. Hooker* (No. 294).
Caulis circiter uncialis, gracilis, foliis fuscescentibus. *G. elongatæ* similis, sed theca in pedunculo cygnicolli et structura foliorum aliena. *Folia* in statu sicco non incurva sed laxe appressa.

6. G. inflectens (*Mitten*). Monoica, caule cæspitoso humili ramoso, foliis siccitate incurvis e basi elliptica erecta sensim lanceolatis patulis, apicibus incurvis supremis hyalino-piliferis, nervo percurrente, marginibus recurvis, cellulis basi angustis elongatis parallelogrammaticis superne dimidium versus partis ellipticæ majoribus oblongis quadratisque pellucidis utrinque ad margines aggregatis et ¼ latitudinis folii ipsius efformantibus, superioribus quadrato-rotundatis distinctis, perichætialibus basi latioribus convolutaceis apice hyalinis, theca in pedunculo brevi cygnicolli perichætium longitudine æquante parva ovata lævi, operculo conico brevi rostrato, peristomio dentibus solidis, flore masculo ad basin perichætii gemmiformi, antheridiis elongatis.
G. funalis, *Wils. l. c.* p. 323.
Hab. In Nepal orient. reg. alp., *J. D. Hooker*! (No. 248, ex parte).
G. reduncæ similis, foliis longioribus basi diverso modo areolatis, floreque masculo ad basin perichætii distincta. A *G. uncinata*, curvatione foliorum exsiccatorum simili, structura baseos discrepans.

7. G. MACROTHECA (*Mitten*). Monoica, caule cæspitoso breviusculo ramoso, foliis patentibus e basi ovali late lanceolatis apice hyalino brevi piliferis nudisve, nervo percurrente, marginibus recurvis, cellulis basi laxis oblongis parallelogrammaticis, superne minutis obscuris, perichætialibus apice angustioribus, theca in pedunculo elongato cygnicolli-flexo anguste elliptica subcylindrica, operculo conico rostrato, peristomio dentibus lanceolatis lævibus rubris.

G. oblonga, *Wils. l. c.* p. 323.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 316).

8. G. commutata, *Hübner*. (G.? incana, planta mascula, *Wils. l. c.* p. 323, quoad specimen No. 281.)

Hab. In Himalayæ occident., Kashmir, et Tibet. occid. reg. temp., *T. Thomson*! (No. 281, 282, 317, 319, 327).

9. G. ovata, *Web. et Mohr.*; *Griff. Not.* p. 413; *Icon. Plant. Asiat.* ii. t. lxxix. f. 4. (G. lurida, ex parte, *Wils. l. c.* p. 323.)

Hab. In Himalayæ orient. reg. temp. et alp., Sikkim, *J. D. Hooker*! (No. 283, 284, 285, 291, 299, 307, 320, 325). In mont. Nilghiri, *Gardner*! In mont. Khasian., ad rupes et monumenta circa Moflong abundans, *Griffith*! In Ceylon insula, *Gardner*! (No. 329).

Specimina No. 285, *G. lurida*, Wils. MSS., cum Funkianis *G. affinis*, Hsch., conveniunt, et ab aliis, foliis inferne paululum angustioribus et statura parum graciliore, tantillum recedunt.

10. G. Nilghiriensis, *C. Müller, Bot. Zeit.* 1853, p. 62.

Hab. In mont. Nilghiri, *Schmid*.

Si inflorescentia vere dioica sit, species distincta; sed specimina Nilghiriana supra ad *G. ovatam* adscripta certe monoica inveni.

11. G. STRICTIFOLIA (*Mitten*). Dioica? caule elongato parce ramoso subsimplici, foliis patentibus strictis e basi subovali lanceolatis obtusis nervo crasso percurrente carinatis margine recurvis, cellulis baseos ad marginem parvis pellucidis oblongis in medio luteis parietibus interruptis in massam subindistinctam conflatis superioribus minoribus obscuris, perichætialibus basi parum latioribus cæteroquin conformibus, theca in pedunculo brevi ovali cylindrica, operculo conico rostro obtuso, peristomio dentibus lanceolatis subcrenulatis, annulo angusto.

Hab. In Himalayæ orient. reg. alp., Sikkim, *J. D. Hooker*!

G. protensæ habitu similis, gracilior tamen, fusca, operculo conico-obtuso, peristomio dentibus solidioribus.

12. G. FUSCESCENS (*Mitten*). Dioica, cæspitosa, caule elongato ramoso, foliis patentibus e basi ovali lanceolatis apice angustis sæpe hyalino-piliferis nervo percurrente carinatis, marginibus recurvis, cellulis baseos ad margines serie unica cellularum pellucidarum cæteris minutis seriatis omnibus conformibus distinctis, perichætialibus pluribus ovatis convolutis erectis interioribus longioribus, theca in pedunculo se-

munciali ovali, operculo subulato æquilongo, peristomio dentibus dicranis in membrana paulisper exsertis.

Racomitrium fuscescens, *Wils. l. c.* p. 324.

Hab. In Himalayæ orient. reg. alp., Sikkim, *J. D. Hooker* (No. 304).

G. microcarpæ similis, foliis autem statu sicco strictioribus, colore intensiore fuscescente, foliis perichætialibus abbreviatis a caulinis diversiformibus.

Obs. *Grimmia No.* 3, Griff. Not. p. 413, ad speciem quamdam *Bartramiæ* pertinet.

§ 3. *Rhacomitrium.*

13. G. subsecunda. (Trichostomum, *Hook. et Grev.*)

Hab. In Himalayæ reg. temp., Sikkim, *J. D. Hooker*! (No. 280, 300, 301, 312, 313, 323). Nepal, *Wallich*! Kumaon, *Strachey et Winterbottom*!

14. G. lanuginosa. (Trichostomum, *Hedw.*)

Hab. In Himalayæ orient. reg. alp., Sikkim, *J. D. Hooker* (No. 309, 315).

15. G. canescens. (Trichostomum, *Hedw.*)

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 306). In Ceylon, *Gardner*!

16. G. Himalayana (*Mitten*). Dioica, cæspitosa, caule decumbente ramoso, foliis patenti-divergentibus apicibus recurvis sæpe hyalino-apiculatis e basi ovata lanceolatis nervo percurrente carinatis marginibus recurvis, cellulis quasi seriatis confluentibus conformibus opacis parietibus pellucidis, perichætialibus interioribus tribus erectis elongate oblongis breviter apiculatis convolutis, theca in pedunculo semunciali ovali erecta, operculo subulato subæquilongo, peristomio dentibus breviusculis solidis bipartitisve, annulo simplici.

Racomitrium pumilum et R. subsecundum ex parte, *Wils. l. c.* pp. 324, 325.

Hab. In Himalayæ centralis et orient. reg. temp. et alp., Sikkim, *J. D. Hooker* (No. 298, 301, 305, 321, 326). Nepal, *Wallich*!

G. fasciculari habitu similis, gracilior, ramis geniculatis.

17. G. Khasiana (*Mitten*). Caule elongato simpliciusculo, foliis e basi suberecta superne dilatata patulis sensim lanceolatis nervo percurrente apice longiusculo hyalino piliferis, pilo minute dentato, cellulis basi ad medium folii oblongis mox in minutas rotundatas superne indistinctas transeuntibus.

G. commutata, *Wils. l. c.* p. 324.

Hab. In mont. Khasian. reg. temp., ad rupem Kollong, inter *Cladonias*. *J. D. Hooker et T. Thomson*! (No. 279).

G. elatior habitu facie staturaque similis, sed foliis a basi angustiore cito

dilatatis quasi folia vaginantia formantibus, præterea cellularum forma diversa.

A *G. commutata* foliorum forma satis diversa.

18. G. Nepalensis. Monoica, caule brevi ramoso, foliis e basi subovali erecta sensim lanceolatis patulis apice incurvis, nervo percurrente, marginibus recurvis, cellulis basi elongatis parallelogrammaticis ad margines in partem latissimam portionis ovalis in latiores brevioresque oblongas quadratasque pellucidas deinde in minutas oblongas rotundasque angulatas transeuntibus, perichætialibus latioribus convolutaceis, theca in pedunculo brevi cygnicolli flexo ovali plicata, flore masculo in ramorum axillis.

G. funalis, *Wils. l. c.* p. 323.

Hab. In Nepal orient. reg. alp., *J. D. Hooker*! (No. 248, ex parte).

G. Schultzii (*Dryptodon*, Brid.) similis, sed foliis siccitate curvatis subcrispatis, pilo hyalino vix conspicuo et structura foliorum supra descripta distincta.

19. G. elongata, *Kaulf.* (G. orientalis, *Wils. l. c.* p. 323.)

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*!

3. Glyphomitrium, *Brid.*

(Brachysteleum, *Rchb.*; Notarisia, *Hampe*; Ptychomitrium, *B. & S.*; Brachyodus, *Furnr.*; et Campylosteleum, *B. & S.*)

Inter genera sic dicta supra memorata differentiam nullam inveni; structura foliorum, thecarum, peristomii, et *calyptræ* forma, etiam habitu et habitatione, omnino eadem sunt.

1. G. Tortula, *Mitten.* (Didymodon, *Harvey*; *Hook. Icon. Plant. Rar.* t. 18. f. 2.—Ptychomitrium speciosum, *Wils. l. c.* p. 325.)

Hab. In Himalayæ reg. temp., Sikkim, *J. D. Hooker*! (No. 246). Nepal, *Wallich*! *J. D. Hooker* (No. 245, 247). Kumaon, *Strachey et Winterbottom*! In mont. Nilghiri, *Gardner*!

2. G. Indicum, *Mitten.* (Trichostomum, *Willd.*—Brachysteleum, *C. Müller, Synops.* i. p. 768.)

Hab. In India orient. (*Herb. Willdenow*).

§ V. Orthotrichaceæ.

Orthotrichaceæ ex parte, Zygodontaceæ ex parte, *Schimp. Coroll.*

1. Drummondia, *Hook.*

1. D. Thomsoni (*Mitten*). Monoica, caulibus repentibus, ramis numerossissimis erectis stratum densum formantibus, foliis rameis patentibus elongato-oblongis obtusiusculis acuminatisque nervo sub apice evanido carinatis, marginibus integerrimis, cellulis ubique parvis

parum obscuris lævibus, perichætialibus majoribus erectis obtusis convolutis, theca in pedunculo breviusculo ovali, operculo conico subulato, calyptra ad basin thecam tegente straminea nitida, flore masculo parvo in ramorum apicibus gemmiformi.

D. brevifolia, *Wils. l. c.* p. 325.

Hab. In Tibet. occid. reg. temp., rupestribus, *T. Thomson* (No. 237).

D. clavellatæ simillima, foliis tamen haud ovato-elongatis sed fere ejusdem latitudinis a basi ad apicem, ubi acuminare incipiunt, apice acutatis plus minusve in acumen productis, structura illis *D. clavellatæ* omnino similibus. *Theca* in speciminibus omnibus adeo juvenilis ut peristomium explorari non potest.

2. Zygodon, *Hook. et Tayl.*

1. Z. obtusifolius, *Hook.*

Hab. In Himalayæ reg. temp., Sikkim, *J. D. Hooker* ! (No. 204). In Nepal, *Wallich* !

2. Z. acutifolius, *C. Müller, Bot. Zeit.* 1833, p. 58.

Hab. In mont. Nilghiri, *Schmid* !

3. Z. brevisetus (*Wils. l. c.* p. 325). Dioicus, cæspitosus, caule sub perichætio innovante dichotomo, foliis patulis recurvis siccitate rectis incurvisque late lanceolatis obtusis acutatis nervo sub apice evanido carinatis, cellulis minutis subobscuris papillosis, perichætialibus basi latioribus, theca in pedunculo gracili luteo pyriformi leviter 8-striata, peristomio nullo.

Hab. In Himalayæ orient. reg. temp., Sikkim, ad truncos arborum, *J. D. Hooker* ! (No. 198).

Z. conoideo (*Z. Brebissonii*, Bryol. Europ.) similis; sed folia breviora et obtusiora. *Caulis* uncialis. *Pedunculus* trilinearis. A *Z. intermedio* collo thecarum longe pyriformi differt.

4. Z. cylindricarpus, *C. Müller, Bot. Zeit.* 1853, p. 59.

Hab. In mont. Nilghiri, *Schmid* ! *Gough* !

5. Z. tetragonostomus, *Braun.*

Hab. In mont. Nilghiri, *Perrottet* ! *Gough* ! *Schmid* !

6. Z. strictus (*Mitten*). Cæspitosus, caule dichotomo, foliis erecto-patentibus elongato-ellipticis acutis nervo crassiusculo in apiculum brevissimum excurrente carinatis, marginibus integerrimis lævibus, cellulis basi paucis parallelogrammaticis totam folii latitudinem occupantibus superioribus minutis distinctis lævibus.

Z.? viridissimo aff., *Wils. l. c.* p. 325.

Hab. In Himalayæ orient. reg. alp., Sikkim, ad rupes? *J. D. Hooker* ! (No. 292).

Z. viridissimo magnitudine similis, ab eo tamen et affinibus foliis strictis nullibi recurvis, nervo excurrente statim dignoscitur. Foliorum forma

elongate elliptica iis *Z. Menziesii* non dissimilis, sed substantia firmiore diversa. An *Drummondia?*

3. Orthotrichum, *Hedw.*

1. O. anomalum, *Hedw.* (O. leptocarpum, *Wils. l. c.* p. 326.)
Hab. In Himalayæ occident., Kashmir, et Tibet. occid. reg. temp., *T. Thomson*! (No. 209, 210 *b*, 251).

2. O. cupulatum, *Hoffm.*
Hab. In Himalayæ occidentalis reg. temp., Kashmir, *T. Thomson*! (No. 210).

3. O. obtusifolium, *Schrad.*
Hab. In Himalayæ occidentalis reg. temp., ad flumen Chenab (cum *O. fastigiato* intermixtum), *T. Thomson*!

4. O. crenulatum (*Mitten*). Monoicum, humile, pulvinatum, foliis patulis elongato-ellipticis obtusis nervo sub apice caviusculo evanido margine reflexo apice in superioribus crenulatis, cellulis amplis iis *O. Sprucei* similibus, theca pyriformi 8-plicata, peristomio dentibus 8 bigeminatis, calyptra pallida nuda.
Hab. In Tibet. occid. reg. temp. ad Rondu (inter cæspites *Drummondiæ Thomsoni*), *T. Thomson*!
O. Sprucei maxime affine, sed foliis apicem versus paululum angustioribus caviusculis apice, absque apiculo, erosis, theca paululum breviore et colore foliorum pallidiore diversum puto, quamvis persimillimum.

5. O. fastigiatum, *Bruch in Brid.* i. p. 785. (O. alpestre, *Wils. l. c.* p. 326.)
Hab. In Himalayæ occident. reg. temp., Kashmir et ad flumen Chenab, *T. Thomson*! (No. 212, 252).

6. O. rupestre, *Schleich.*
Hab. In Himalayæ occident. reg. temp., Kashmir, *T. Thomson*! (No. 208).

7. O. speciosum, *Nees ab E.*
Hab. In Himalayæ orient., Sikkim, *J. D. Hooker*; et in Tibet. occident. reg. alp., *T. Thomson*! (No. 211).
Specimina fructu juvenili, sed a specie europeana non diversa videntur.

8. O. Hookeri (*Wils. l. c.* p. 326). Monoicum, laxe cæspitosum, caulibus sæpe decumbentibus dichotomis elongatis subsimplicibusve, foliis e basi elliptica suberecta sensim lanceolatis acutis patenti-divergentibus siccitate patentibus strictis acutis nervo sub apice evanido carinatis, marginibus reflexis, cellulis minutissimis ovoideis conformibus minute papillosis basi infima ad nervum paucis elongatis flavidis marginalibus inconspicuis, perichætialibus conformibus, theca in pedunculo elongato ovali cylindrica lævi ad os plicata, operculo

conico-subulato, peristomio dentibus geminatis, ciliis latis alternatim brevioribus, calyptra thecam totam obtegente parce ramentacea.

Hab. In Himalayæ reg. alp. et temp., Sikkim, *J. D. Hooker* ! (No. 215, 217). Nepal, *Wallich* ! *J. D. Hooker* ! (No. 213). Kumaon, *Strachey et Winterbottom* !

O. specioso rigidior, foliis cellulis minoribus firmis et theca in pedunculo longiore.

4. ULOTA, *Brid.*

1. U. ROBUSTA (*Mitten*). Monoica, cæspitosa, caule elongato dichotomo, foliis e basi late ovali erecta lanceolatis divergentibus patulis siccitate crispatis nervo sub apice evanido carinatis, marginibus integerrimis uno latere sæpe recurvis, cellulis basi elongatis angustis ad marginem serie unica pellucidarum mox in rotundatas inter se subdistantes transeuntibus, dorso papillosis, perichætialibus erectis basi latiore longiore, theca in pedunculo longiusculo crasso ovalı macrostoma 8-plicata, operculo planiusculo brevi-rostrato, peristomio dentibus bigeminatisa picibus liberis, ciliis octo latis, calyptra ramentacea, flore masculo in axillis foliorum gemmiformi.

Orthotrichum robustum, *Wils. l. c.* p. 327.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* ! (No. 216, 219, 244).

Caulis uncialis–sesquiuncialis. *Pedunculus* tri- quadrilinearis. *U. phyllantho* statura similis, sed foliis a basi erecta ovali angustatis patulis et cellulis paulum majoribus recedit. Ab *O. Bruchii* caulibus minus confertis, foliis laxioribus, pedunculo crasso et theca brevi diversa.

2. U. Schmidii, *Mitten*. (Orthot., *C. Müller, Bot. Zeit.* 1853, p. 61.)

Hab. In mont. Nilghiri, *Schmid.*

5. MACROMITRIUM, *Brid.*

1. M. Perrottetii, *C. Müller, Synops.* i. p. 721.

Hab. In mont. Nilghiri, *Perrottet* ! In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* ! (No. 239).

2. M. squarrulosum, *C. Müller, Bot. Zeit.* 1853, p. 61.

Hab. In mont. Nilghiri, *Schmid.*

3. M. CALYCINUM (*Mitten*). Monoicum, humile, caule repente ramis brevibus dense confertis erectis, foliis patentibus lanceolatis sensim acutis nervo sub apice evanido carinatis marginibus integerrimis medio recurvis, cellulis basi paucis ad nervum parallelogrammaticis cito in quadratas parvas rotundatasque distinctas transeuntibus, perichætialibus elongatis erectis late lanceolatis brevi-nervatis in tubum convolutis cellulis elongatis carnosulis areolatis, theca in pedunculo elongato ovali lævi, peristomio dentibus 16 latiusculis brevibus.

M. parvulum, *Wils. l. c.* p. 327.

Hab. In Ceylon, *Gardner* (No. 226).

Parvulum, dense cæspitosum, magnitudinem *Zygodontis viridissimi* vix superans. *Folia perichætialia* caulinis quadruplo longiora. Species primo visu *Drummondiis* affinis.

4. M. Assamicum, *Mitten.* (Orthotrichum, *Griff. Not.* p. 402; *Icon. Plant. Asiat.* ii. t. lxxvii. f. 11.)

Hab. In Assam superiore, alt. 600 (6000?) ped., ad Negrogam et in agro Muttack in arboribus, *Griffith.* Forsan ad *M. Nepalense* referendum.

5. M. Nepalense, *Schw.*

Hab. In Himalayæ reg. temp., Sikkim, *J. D. Hooker*! (No. 214, 218). Nepal, *Wallich.* In peninsula Malayana, ad Tavoy, *Rev. D. Parish.* Etiam in insulis Hong-Kong et Philippinis.

6. M. CALYMPEROIDEUM (*Mitten*). Dioicum? caule arcte repente, ramis brevissimis erectis, foliis patentibus elliptico-lanceolatis lanceolatisque siccitate crispatis apice acutis obtusiusculisve nervo in apice evanido carinatis marginibus integerrimis apicem versus cellulis prominentibus erosis, cellulis rotundatis ubique papillosis distinctis conformibus, perichætialibus brevibus ovato-lanceolatis subserrulatis acutis, theca in pedunculo elongato rubro ovali-cylindrica fusca, operculo conico-subulato, peristomio dentibus geminatis revolutis, calyptra magna thecam totam obvelante basi pedunculum amplectente.

Hab. In peninsula Malayana, ad Tavoy, in arborum truncis, *Rev. D. Parish*!

M. Nepalensi affine, sed ramis brevibus densis, foliis siccitate crispatis haud in spiram contortis erosis, cellulis majoribus ubique distinctis, peristomio dentibus geminatis et calyptra parcius ramentacea diversum.

7. M. SPATHULARE (*Mitten*). Dioicum? caule repente ramis brevissimis densifoliosis, foliis patentibus apicibus incurvis siccitate arcte crispatis spathulatis obtusis nervo sub summo apice evanido carinatis, marginibus integerrimis, cellulis basi oblongis superioribus rotundis minutis distinctis lævibus, perichætialibus longioribus lanceolatis, theca in pedunculo breviusculo ovali, operculo conico-subulato, calyptra thecam ad $\frac{3}{4}$ obtegente ramentacea.

Hab. Ad Madras p., *Wight*! Etiam in imperio Sinensi, ad Chusan, *Alexander*!

A *M. Nepalensi* statura paulo minore, foliis spathulatis apice rotundatis, cellulis distinctis et brevitate calyptrarum recedens.

8. M. Moorcroftii, *Schw.* (M. Moorcroftii, M. tortuosum, et M. pileatum, *Wils. l. c.* p. 327.—Orthotrichum Moorcroftii, *Griff. Not.* p. 401; *Icon. Plant. Asiat.* ii. t. lxxvi. f. 4.)

Hab. In Himalayæ reg. temp., Sikkim, *J. D. Hooker*! (No. 206, 238). In Nepal, *Moorcroft*! *Wallich*! *J. D. Hooker* (No. 243). Kumaon,

T. Thomson! (No. 220). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! (No. 221, 222, 228, 242, 255, 256).

9. M. Muellerianum, *Mitten*. (M. uncinatum, *C. Müller, Bot. Zeit.* 1853, p. 62.)

Hab. In mont. Nilghiri, *Schmid*; *Gardner* (No. 33). Nomen cl. Mülleri "uncinatum" a Bridelio jam abusum.

10. M. Schmidii, *C. Müller, Bot. Zeit.* 1853, p. 61. (M. involutifolium, *Mont., Musci Nilghirienses.*)

Hab. In mont. Nilghiri, *Perrottet*! *Schmid*! *Gardner*! *et Gough*!

11. M. DENSUM (*Mitten*). Dioicum? caule repente, ramis brevissimis dense confertis erectis, foliis patentibus siccitate compacte spiraliter tortis lingulatis obtusissimis retusis nervo tenuiusculo in mucronem brevissimum excurrente carinatis marginibus integerrimis, cellulis ubique parvis rotundis distinctis, perichætialibus conformibus? theca in pedunculo elongato ovali lævi.

Hab. In Nepal, *Wallich*!

M. Wagneriano, habitu aspectuque simile, sed minus, foliis brevioribus retusis haud plicatis. A speciebus reliquis Indicis valde diversum et statu sicco *Drummondiæ clavellatæ* subsimile.

12. M. FASCICULARE (*Mitten*). Monoicum, *M. Reinwardtii* simillimum, sed gracilior, foliis late lanceolatis acutis nervo percurrente carinatis integerrimis, cellulis a basi ad medium elongatis angustis in folii medio ad nervum altius quam ad margines adscendentibus cæteris parvis rotundis distinctis, perichætialibus caulina æquantibus erectis inferne convolutis superne acuminatis, theca in pedunculo elongato gracili ovali, ore plicato, operculo subulato, calyptra ramentis paucis sparsis pilosa.

M. Reinwardtii, *Wils. l. c.* p. 327.

Hab. In Ceylon ad Horton Plains et Newera Ellia, *Gardner*! (No. 225, 229, 230).

M. Reinwardtii valde affine, sed structura foliorum, cellulis minoribus numerosioribus infra medium folii descendentibus et calyptra parce pilosa discrepans.

13. M. SEEMANNI (*Mitten*). Dioicum, luteo-fuscescens, caule repente ramis brevibus fastigiatim ramulosis dense depresso cæspitoso, foliis patentibus elongato-elliptico-lanceolatis nervo sub apice evanido carinatis, cellulis basi angustis elongatis ad folii dimidii longitudinem protractis sensim in minutas rotundatas inter sese distantes transeuntibus lævibus, perichætialibus erectis latioribus acuminatis, theca in pedunculo mediocri crassiusculo breviter ovata lævi ore tantum sulcata, operculo conico-subulato, peristomio dentibus 16 æquidistantibus, calyptra nuda.

Hab. In India orient. (fide speciminis Dicksoniani). Etiam in St. Helena insula copiose legit cl. *Berthold Seemann*!

M. nitido simile, sed paululum robustius, foliis cellulis firmioribus et minoribus. *Florescentia* probabiliter dioica; nam flores masculos, quos in *M. nitido* facillime in ramulorum apicibus invenies, in *M. Seemanni* frustra quæsivi. Inter Macromitria Indica *M. Reinwardtii* proxima species, quam, fortasse errore Dicksoni ad floram Indiæ adscriptam, excludere non audeo.

14. M. sulcatum, *Brid.* (M. Nilgiriense, *C. Müller, Synops.* i. p. 737. —M. sulcatum, M. longifolium, et M. corrugatum, *Wils. l. c.* p. 328. —Schlotheimia sulcata, *Griff. Not.* p. 405; *Icon. Plant. Asiat.* t. lxxviii. f. 1.)

Hab. In Nepal, *Gardner*! *Wallich*! In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 223, 236, 240, 241). In mont. Nilghiri, *Gough*! Ad Bombay, *Kegel*! In Ceylon, *Gardner* (No. 227, 232, 234). Et forma foliis angustioribus, in mont. Nilghiri, *Perrottet*! *M'Ivor*! ad Madras, *Wight*! in Ceylon, *Gardner* (No. 231, 254) *et Thwaites*!

Species latitudine et corrugatione foliorum valde varians, foliis apicem versus erosis subintegerrimisve, cellulis minutis obscuris sed inter se distantibus ut pagina luteo-fulva punctis parvis notata videatur, basin versus nonnullis in paginarum medio papillis grossis armatis, basi infima uno latere tantum ad nervum cellulis laxis pellucidis calymperoideis in formam triangularem aggregatis, quibus notis per variationes omnes statim dignoscere potest.

15. M. CEYLANICUM (*Mitten*). Dioicum? *M. sulcato* simile, foliis patentibus curvatis apicibus erectis siccitate uncinato-incurvis e basi subelliptica angustatis longe lanceolatis apice acuminatis nervo excurrente carinatis margine apice serrulato, cellulis superioribus minutis ovoideis in lineis longitudinalibus distinctis basi papillosis elongatis angustis, perichætialibus erectis brevioribus ellipticis acuminatis, theca in pedunculo semunciali, peristomio et calyptra *M. sulcati*.

M. tersum, *Wils. l. c.* p. 328.

Hab. In Ceylon, *Walker et Gardner* (No. 253).

A *M. sulcato*, quod statura colore necnon thecæ forma et plicatione simulat, ambitu structuraque foliorum distinctissimum.

16. M. FULVUM (*Mitten*). Dioicum, aurantiaco-fuscum, caule repente ramis elongatis simplicibus curvatis, foliis patulo-recurvis siccitate parum mutatis lanceolatis longe sensim angustatis apice breviter apiculatis subintegerrimis margine inferne recurvis nervo sub summo apice evanido carinatis, cellulis basi pluribus elongatis angustis flavidis papillosis superioribus longitudinaliter seriatis ovoideis omnibus distinctis lævibus, perichætialibus erectis basi latioribus, theca in pedunculo brevi gracili globoso-ovata plicata, operculo conico-subulato recte longirostrato, peristomio rubro brevi dentibus in tubulum coalitis, calyptra glabra thecam totam obtegente.

Hab. In Ceylon, ad Rambodde, *Gardner*! (No. 233).

M. cirrhoso robustior, foliis subintegerrimis haud papillosis. A *M. longifolio* præterea statura majore, foliis angustioribus siccitate nec tortis neque crispatis et pedunculo lævi distinctum.

17. M. TORULOSUM (*Mitten*). Dioicum? caule gracili elongato repente et ut videtur pendulo flexuoso, foliis parvis angustis appressis, ramis remotis brevibus scopæformibus, foliis e basi brevi erecta patentibus apicibus erecto-curvatis siccitate uncinato-incurvis mollibus inferne ellipticis inde sensim angustatis lineari-lanceolatis acutis margine altero reflexo apice minutissime eroso nervo percurrente carinatis, cellulis superioribus parvis angulato-rotundatis distinctis infra medium oblongis basi elongatis parce papillosis, perichætialibus paulo brevioribus caulinis fere conformibus, theca in pedunculo bilineari breviter ovata in collum sensim attenuato lævi, operculo subulato, peristomio brevi tubuloso truncato rubro, calyptra profunde laciniata lævi thecam ad ¾ obtegente.

Hab. Ceylon, *Thwaites.*

Color fulvus, ætate fuscus. *M. fulvo* ambitu foliorum simile, sed substantia molliore et apicibus sensim angustatis non acuminatis. Habitu peculiari, caule filiformi flexuoso repente, ramis brevibus crassis et pedunculi brevitate a reliquis speciebus Indicis diversum.

18. M. goniorhynchum, *Mitten.* (Schlotheimia goniorhyncha, *Dozy et Molk. Bryol. Javan.* cum icone, ined.)

Hab. In mont. Khasian. reg. subtrop. sterili, inter *M. sulcatum* repens, *J. D. Hooker et T. Thomson*! Etiam in insulis Javæ et Sumatræ.

19. M. NIGRICANS. Dioicum? caule repente ramis simplicibus apiceve furcatis, foliis e basi erectiuscula patentibus apicibus incurvis siccitate cirrhatis inferne ellipticis sensim superne angustioribus lanceolatis apice abrupte acutatis apiculatis nervo excurrente apice eroso carinatis, cellulis inferioribus angustis lunatis pallidis a basi ad folii medium altius ad nervum quam ad margines adscendentibus inde ad apicem parvis rotundis obscuris, perichætialibus erectis brevioribus ellipticis acutis, theca in pedunculo bilineari subglobosa lævi fusca, peristomio dentibus parvis brevibus inflexis.

Hab. Coorg. In arborum ramulis (*Herb. Van den Bosch*).

Rami unciales nigro-fusci apicibus viridibus. *M. angustifolio* (Dozy et Molk.) subsimile, ramis autem apice tantum furcatis. *M. longicauli* gracilius. Species ob foliorum structuram inter illas peninsulæ Indiæ singularis.

6. SCHLOTHEIMIA, *Brid.*

1. S. GREVILLEANA. Dioica? caule repente, ramis cæspitosis breviusculis ramulosis, foliis patentibus siccitate appressis subtortis ligulatis obtusis brevissime apiculatis nervo excurrente carinatis rugulosis, cellulis inferne angustis superne rotundatis parvis omnibus conco-

loribus fuscis, perichætialibus acutioribus, theca cylindracea in pedunculo sesquilongiore, peristomio dentibus geminatis siccitate recurvis, interno processibus latiusculis fuscis papillosis dentibus brevioribus, calyptra apicem versus scabrella.

Orthotrichum squarrosum, *Griff. Not.* p. 403; *Icon. Plant. Asiat.* t. lxxvii. f. 1.—S. rugifolia, *Greville in Herb. Gardner.*

Hab. In mont. Nilghiri, *Gardner*! In mont. Khasian. in sylvis Myrung ad terram, *Griffith*!

S. rugifoliæ simillima, foliis autem paululum longioribus, haud ovatis, sed dimidio inferiore vix latiore quam dimidio superiore.

§ VI. Funariaceæ.

Ephemereæ et Funariaceæ, *Schimp. Coroll.*

1. Physcomitrium, *Brid.*

1. P. repandum. (Gymnostomum repandum, *Griff. Not.* p. 392.)

Hab. In Assam superiore ad Suddya, *Griffith*! In Nepal, *Wallich*!

Species foliis lanceolatis fere toto ambitu serrulatis et operculo breviter curvirostrato facile discernenda. Statura *P. pyriformi* paulo minor.

2. P. pulchellum (Gymnostomum, *Griff. Not.* p. 393). "Caule simplici, foliis congestis ascendenti-patentibus spathulato-lanceolatis apiculatis repandis marginatis subintegris, vena in apiculum excurrente, capsula turbinato-pyriformi, operculo planiusculo umbonato" (*Griff. l. c.*).

Hab. In Assam superiore circa Suddya (*P. repando* consociatum), *Griffith*!

P. acuminato similis, sed e speciminibus mancis paucis, quæ tantum vidi, distinctum videtur.

3. P. cyathicarpum (*Mitten*). Caule brevissimo, foliis paucis patentibus lanceolatis, nervo in acumine excurrente, marginibus a medio ad apicem serratis, cellulis laxis, theca in pedunculo æquilongo hemisphærica cyathiformi, operculo brevi conico.

P. immersum, *Wils. l. c.* p. 329.

Hab. In Nepal, *Wallich*! In planitie Panjab Gangetica, ad Ferozepore, *T. Thomson*! (No. 361 *b*).

P. immerso (Sullivanti) persimile, sed foliis latioribus, cellulis laxioribus latioribus longioribusque et operculo breviore. Substantia thecæ crassiuscula, sed textura laxa tenera. Flos masculus ut in affinibus.

2. Entosthodon, *Schw.*

1. E. Buseanus, *Dozy et Molk. Bryol. Javan.* p. 31, t. xxii. (E. flavescens, *Wils. l. c.* p. 329.)

Hab. In Ceylon, *Gardner* (No. 356). In mont. Nilghiri (inter *Marchantiam nitidam*), *Perrottet*!

2. E. Perrottetii. (Physcomitrium, *Mont.*)
Hab. In mont. Nilghiri, *Perrottet*!
Peristomium dentibus brevibus pallidis in specimine a cl. Montagneo mihi benevolentissime donato observavi.

3. E. physcomitrioides, *Müller*. (Funaria, *Mont.*)
Hab. In mont. Nilghiri, *Perrottet*!
Peristomium simplex, et dentium directio recta potius hujus generis.

4. E. Wallichii (*Mitten*). *E. Templetoni* similis, foliis subspathulatis apiculatis acutis, nervo ad $\frac{3}{4}$ evanido, margine non incrassato apicem versus serrulato, cellulis laxis, theca in pedunculo gracili elongato pyriformi, peristomio nullo?
Weissia Templetoni, *Griff. Not.* p. 406; *Icon. Plant. Asiat.* ii. t. lxxviii. f. 11.
Hab. In Nepal, *Wallich*! In mont. Khasianis ad Moflong, *Griffith*!
Habitu *E. Templetoni*, sed longe gracilior, foliis multo angustioribus apiculatis serratis. Folia in icone Griffithiana ad specimina vix quadrant.

5. E. diversinervis, *C. Müller, Bot. Zeit.* 1853, p. 20.
Hab. In mont. Nilghiri, *Schmid*.

6. E. submarginatus, *C. Müller, l. c.*
Hab. In mont. Nilghiri, *Schmid*.

7. E. Rottleri, *C. Müller*. (Gymnostomum, *Schw.*)
Hab. In India orient., *Rottler et Wight*!

8. E. pilifer (*Mitten*). Caule brevi, foliis obovatis ellipticisve in apiculum piliformem acuminatis, nervo in apicem percurrente, margine apice indistincte serrulato, cellulis laxis, theca in pedunculo elongato pyriformi, operculo conico obtuso.
Hab. In Tibet. occid. reg. temp., *T. Thomson*!
E. fasciculari similis, foliis autem piliferis. An peristomatus sit, specimina thecis immaturis non elucent.

9. E. nutans (*Mitten*). Caule breviusculo, foliis paucis patentibus elliptico-lanceolatis longe attenuatis, nervo superne evanido, margine a medio ad apicem serratis, cellulis laxis, theca in pedunculo elongato cygnicolli-flexo pendula subglobosa, operculo plano, calyptra parva dimidiata.
Physcomitrium nutans, *Wils. l. c.* p. 329.
Hab. In planitie Panjab ad Ferozepore, *T. Thomson* (No. 355).
Caulis linearis. *Pedunculus* bilinearis. *Physcomitrio cyathicarpo* statura adspectuque similis. *Theca* in pedunculo gracillimo, pro plantula magna, nutans.

3. Funaria, *Schreb.*

1. F. hygrometrica, *Dill.*

Hab. In Himalayæ totæ reg. temp., Sikkim, *J. D. Hooker*! (No. 334, 365). Simla, etc., *T. Thomson*! (No. 333, 338, 340, 342, 363, 371 *b*). Ad flumen Chenab, *T. Thomson*! (No. 330, 337). In Tibet. occid. reg. temp., *T. Thomson*! (No. 350, 351, 353, 357, 358, 360); et in reg. alp. (No. 335, 362). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! (No. 343, 349). In Ceylon, *Gardner*.

Tabulæ in *Icon. Plant. Asiat.* ii. t. cix. et cx., evolutionem exhibentes fortasse ad hanc speciem pertinent.

2. F. leptopoda, *Griff. Not.* p. 437.

Hab. In Himalayæ reg. temp., Nepal, *Wallich*! *et J. D. Hooker*! (No. 369); Kumaon, *T. Thomson*! (No. 367), *J. D. Hooker*! (No. 346). In mont. Khasian. in sylvis Myrung, *Griffith*! Etiam in Java, *Junghuhn*!

Species an vere distincta a *F. calvescente* et *F. hygrometrica* sit, vix dijudicare queo; a priore foliis angustis siccitate incurvis subcrispatis differt.

3. F. Nepalensis, *C. Müller, Bot. Zeit.* 1855, p. 748.

Hab. In Nepal (*Herb. Kunze*).

4. F. connivens, *C. Müller, Bot. Zeit.* 1855, p. 747.

Hab. In mont. Nilghiri, *Perrottet et Schmid.*

5. microstoma, *B. & S.*

Hab. In Tibet. occid. reg. temp., *T. Thomson*! (No. 332, 354); et in reg. alp. (No. 331, 352).

6. F. Muhlenbergii, *Schw.*

Hab. In Himalayæ boreali-occident. reg. temp., *T. Thomson*! (No. 364).

7. F. orthocarpa. Monoica, caule humili, foliis ovatis longiuscule in acumen piliforme acuminatis flaccidis nervo ultra medium evanido marginibus integerrimis, cellulis laxis, perichætialibus ovalibus acuminatis, theca in pedunculo brevi ovali erecta æquali, collo sensim in pedunculum attenuato, operculo conico, calyptra magna, peristomio externo dentibus rubris sublævibus interno processibus filiformibus brevioribus punctulatis.

Hab. In Tibet. occid. reg. temp., *T. Thomson* (No. 366).

Species parva, magnitudine *Entosthodonte ericetorum* minor; potius inter *Funarias* posui, quamvis e peristomio ab *Entosthodontibus* non multum recedit.

§ VII. Splachnaceæ.

Voitiaceæ et Splachnaceæ, *Schimp. Coroll.*

1. Voitia, *Hornsch.*

1. V. Hookeri (*Mitten*). Monoica, *V. nivali* simillima, foliis sub-

panduriformibus, cellulis minoribus firmioribus oblongis parallelogrammaticis inferne longioribus, theca *V. nivalis.*

V. stenocarpa, *Wils.*, si non V. nivalis var. *Wils. l. c.* p. 329.

Hab. In Himalayæ orient. reg. temp. et alp., Sikkim, *J. D. Hooker!* (No. 379).

Primo visu *V. nivali* omnino similis, sed foliis panduriformibus et substantia diversa satis distincta.

2. Tayloria, *Hook.*

§ 1. *Orthodon*, Brid.

1. T. Indica. (Octoblepharum serratum, *Hook. Musc. Exot.* i. 136, excl. synon. O. serratus, *Bory.*)

Hab. In Himalayæ reg. temp., Sikkim, *J. D. Hooker!* (No. 386, 387, 389). Nepal, *Gardner! Wallich! J. D. Hooker!* (No. 388). Kumaon, *Strachey et Winterbottom!*

T. Boryanæ (*Orthodonti serrato*) simillima, sed calyptra ramentis elongatis sericeis stramineis ornata.

2. T. subglabra. (Orthodon subglaber, *Griff. Not.* p. 399; *Icon. Plant. Asiat.* ii. t. lxxvi. f. 2.)

Hab. In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson!* (No. 390). "In arboribus vigentibus mortuisve in sylvis Mumbree; in arboribus et rupibus in sylvis Myrung," *Griffith!*

T. Indicæ, T. Boryanæque simillima, sed calyptra apice tantum scabra, cæterum glabra.

§ 2. *Dissodon*, Hornsch.

3. T. Jacquemontii (*Schimper, in lit.*). Monoica, caule elongato ramoso, foliis patentibus subtortis obovatis spathulatis obtusiusculis nervo sub apice evanido margine superne subserrato, cellulis laxis marginalibus paulo majoribus pellucidioribus, theca in pedunculo elongato rubro ovali cylindrica collo subnullo erecta, operculo conico, peristomio dentibus octo solidis lævibus, calyptra lævi sporis diametro $\frac{1}{2000}$ unciæ metientibus.

Dissodon Jacquemontii, *Schimper*; *C. Müller, Synops.* i. p. 139.

Hab. In Himalayæ occidentalis reg. temp., alt. 9000 ped., loco Deorah secus fontem Gherry, *Jacquemont!*

Species pulcherrima. A *T. Frœlichia*, foliis subtortis et theca cylindrica basi subito in pedunculum angustata, diversa.

4. T. tenella (*Mitten*). Monoica? caule elongato gracili, foliis patentibus elliptico-spathulatis obtusis nervo sub apice evanido margine apice cellulis paululum angustatis indistincte serrato, cellulis laxis oblongis marginalibus paulo majoribus indistincte coloratis, theca in pedunculo breviusculo ovali-cylindrica in collum sensim attenuato, operculo convexo columella adhærente siccatione exserto, peristomio

dentibus octonis pallidis geminatis angustatis erosis, sporis diametro $\frac{1}{600}$ unciæ metientibus.

Hab. In Himalayæ occidentalis reg. temp., Kumaon, alt. 9000 ped. ad Champwa, *Strachey et Winterbottom.*

T. Jacquemontii habitu foliisque similis, sed dimidio minor, foliis obtusioribus cellulis paululum majoribus, theca in collum sensim attenuata et peristomio teneriore dentibus angulato-erosis.

3. Splachnum, *L.*

1. S. urceolatum, *Bryol. Europ.* (Tetraplodon, *B. & S.*)

Hab. In Himalayæ orient. reg. alp. et temp., Sikkim, *J. D. Hooker*! (No. 373, 374, 376, 380, 384).

2. S. mnioides, *Hedw.*

Hab. In Himalayæ orient. reg. temp., Sikkim., *J. D. Hooker*! (No. 372, 377, 381, 385).

3. S. angustatum, *Linn.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 375).

§ VIII. Bartramiaceæ.

Meesiaceæ, Bryaceæ ex parte, et Bartramiaceæ, *Schimp. Coroll.*

1. Meesia, *Hedw.*

1. M. uliginosa, *Hedw.*

Hab. In Himalayæ orient. reg. alp., Sikkim, *J. D. Hooker*! (No. 348).

2. Oreas, *Brid.*

1. O. Martiana, *Brid.*

Hab. In Himalayæ orient. reg. alp., Sikkim, *J. D. Hooker*! (No. 571, 591).

3. Bartramia, *Hedw.*, *Brid.*

1. B. pomiformis, *Hedw.*, var. crispa.

Hab. In Himalayæ occidentalis reg. temp., ad flumen Chenab, *T. Thomson*! (No. 605).

2. B. Halleriana, *Hedw.*

Hab. In Himalayæ reg. temp., Sikkim, *J. D. Hooker*! (No. 590, 595). Kumaon, *Royle*!

Folia magis crispata sunt quam in forma vulgari; cæteroquin non diversa.

3. B. subulata, *B. & S. Bryol. Europ.*

Hab. In Himalayæ orient. reg. alp., Sikkim, *J. D. Hooker*! (No. 570).

4. B. leptodonta (*Wils. l. c.* p. 369). Monoica synoicave, caule subsimplici, foliis e basi oblonga superne dilatata erecta cellulis elon-

gatis pellucidis areolata subito subulato-lanceolatis, cellulis minoribus viridibus subobscuris, dorso papilloso-erosis nervo excurrente carinatis margine minute dense serrulatis, perichætialibus conformibus, theca in pedunculo elongato globosa erecta subinclinatave leptodermi lævi siccitate corrugata, ore parvo, operculo plano-convexo, peristomio externo dentibus rubris interno carente.

Hab. In Himalayæ reg. temp., Sikkim, *J. D. Hooker*! (No. 573). Kumaon, *Strachey et Winterbottom*!

Habitu colore staturaque *B. ithyphyllæ* similis, sed foliis basi duplo latioribus et superne nervo distincto, marginibus densius serrulatis, cellulis in parte superiore minus obscuris, et theca non plicata, peristomio simplici externo.

5. B. SUBPELLUCIDA (*Mitten*). Synoica, *B. ithyphyllæ* simillima et foliis ejusdem formæ, sed nervo ubique distincto, marginibus argutius et densius serrulatis ad basin partis superioris reflexis, cellulis oblongis subpellucidis, perichætialibus conformibus, theca in pedunculo elongato inclinata globosa plicata, peristomio *B. ithyphyllæ*.

Hab. In Himalayæ reg. temperata, ad Kumaon, *Strachey et Winterbottom*. In Nepal orient. ad flumen Ratong, fragmentum tantum, *J. D. Hooker*!

B. ithyphyllæ persimillima, sed foliis siccitate minus strictis et structura partis superioris cellularum iis *B. ithyphyllæ* dimidio brevioribus et latioribus subpellucidis, nervo ubique distincto statim dignoscendum. *Theca* et *peristomium*, quantum e speciminibus fructu vetusto discerni potest, iis *B. ithyphyllæ* similia.

4. PHILONOTIS, *Brid.*

1. P. Roylei, *Mitten*. (Glyphocarpus, *Hook fil.*; *Hook Icon. Plant. Rar.* t. 194 *c.*)

Hab. Himalaya occident., *Royle*. In mont. Nilghiri, *Perrottet*! *Schmid*!

2. P. GRIFFITHIANA (*Mitten*). Dioica? cæspitosa, caule sub perichætio ramis pluribus innovante, foliis erecto-patentibus ovatis longe acuminatis nervo in apice evanido dorso dentato marginibus serrulatis recurvis, cellulis elongatis angustis basi parum latioribus papillosis, perichætialibus hastatis acuminatis, theca in pedunculo rubro elongato globosa lævi sicca vix sulcata, operculo plano umboneve minuto, peristomio externo dentibus brevibus rubris interno brevissimo rudimentario.

Bartramia Griffithiana, *Wils. in Sched.* (Weissia Bartramioides, *Griff. Not.* p. 407; *Icon. Plant. Asiat.* ii. t. lxxviii. f. 3.)

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 574, 593, 596, 611, 616). In mont. Khasian., *Griffith*! reg. temp., *J. D. Hooker et T. Thomson*! (No. 560, 603).

Glauco-viridis, habitu staturaque *P. filiformis* (*Bartramia*, Hsch.), sed paululum robustior. Species theca lævi peristomate erecto trans-

itum *Bartramidularum* in *Philonotem* pulchre ostendens, et a reliquis affinibus jam distincta.

Florescentia fide Griffithii synoica; sed antheridia frustra quæsivi.

3. P. GLOMERATA (*Mitten*). Dioica, cæspitosa, planta mascula caule gracili ramoso, foliis strictis imbricatis appressis anguste ovatis acuminatis nervo crassiusculo excurrente margine recurvo serrulato, cellulis superne angusto-oblongis distinctis inferne abbreviatis subquadratis perigonialibus in gemmam superne apertam imbricatis late ovatis brevi acuminatis internis suborbiculatis vix apiculatis tenuiter nervatis.

Bartramia glomerata, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. alp., Sikkim, *J. D. Hooker*! (No. 597).

Statura modoque imbricationis foliorum *P. imbricatulæ* similis, a qua foliis cellulis firmioribus luteis, et forma perigonialium minus elongata recedere videtur. Cellularum forma convenit.

4. P. LEPTOCARPA (*Mitten*). Dioica, gregaria, caule brevi gracili, foliis strictis erectis lanceolato-subulatis planis, nervo longe excurrente parce denticulato, marginibus serrulatis angustissime vel non recurvis, cellulis elongato-oblongis laxis basi laxioribus pellucidis, perichætialibus longioribus nervo longiore excurrente, theca in pedunculo rubro gracili globosa inclinata leptodermi plicata, operculo obtuse conico, peristomio dentibus breviusculis latis interno ciliis carente lævi.

Bartramia mollis, var., *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, alt. 12,000 ped. *J. D. Hooker*! (No. 610).

Caulis bi- quadrilinearis. Gracilis, *P. Roylei* non dissimilis, foliis e basi æquilatis pro spatio longitudine bis latitudinem æquante, cellulis laxis, deinde sensim lanceolato-subulatis teneris, nervo longe excurrente et quamvis undulato directione stricta.

A *P. molli* (*Bartramia*, Dozy et Molk.), statura longe minore, foliis strictis rigidulis erectis appressis, valde diversa.

5. P. THWAITESII (*Mitten*). Dioica, cæspitosa, caule brevi, foliis patentibus subsecundis ovato-lanceolatis nervo excurrente marginibus recurvis serrulatis, cellulis minutis breviter oblongis superne obscuris, perichætialibus longioribus angustioribus, theca in pedunculo elongato globosa inclinata plicata, operculo breviter conico obtuso, peristomio dentibus breviusculis latis interno ciliis nullis processibus angustis apicibus striatulis, flore masculo foliis perigonialibus ovatis longe lanceolatis acuminatis.

Hab. In Ceylon, *Thwaites*! *Caulis* tri- sexlinearis. *Pedunculus* biuncialis. *Folia* densiuscula statu sicco appressa paululum flexuosa. Habitu *P. Griffithianæ* similis, sed foliis minus rigidis et theca inclinata gibba et plicata. *P. filiformi* etiam similis, sed foliis tenuioribus et angustioribus.

6. P. SUBULOSA (Bartramia, *Griff. Not.* p. 438; *Icon. Plant. Asiat.* ii. t. 101. f. 2). Dioica, cæspitosa, habitu *P. Turnerianæ,* foliis erectis strictis appressis lanceolatis longiusculis angustis planiusculis nervo crassiusculo longe excurrente marginibus anguste recurvis serrulatis, cellulis elongatis basi latioribus, perichætialibus nervo longius excurrente, theca in pedunculo elongato globosa sulcata, operculo convexo, peristomio dentibus rubris, interno ciliis carente, flore masculo foliis perigonialibus e basi oblonga erecta lanceolatis patulis.

Hab. "In montibus Khasia, ripis arenosis rivuli Maamloo, Deboro et Rangagurrah agri Singfoensis," *Griffith*!

P. Turneriana gracilior, foliis densioribus strictioribus appressis, non profunde carinatis, angustis.

Plantula illa, a beato Griffithio pro var. A. memorata, mihi non visa; sed sub hoc nomine specimen parvulum *Leptotrichi* cujusdam *L. pomiformi* affinis, a Griffithio missum, in Herb. Wardiano asservatum est.

7. P. ANGUSTA (*Mitten*). Dioica, cæspitosa, foliis erecto-patentibus sæpe subsecundis ovato-lanceolatis nervo excurrente marginibus serrulatis, cellulis elongatis basi oblongis, perichætialibus e basi late ovata subulatis, theca in pedunculo elongato magna globosa plicata, operculo convexo, peristomio interno processibus lævibus.

B. prætenuis *et* B. angustata, *Wils. in Sched.*

Hab. In Ceylon, *Gardner* (No. 601, 615). In Himalayæ orient. reg. temp. (non omnino cum speciminibus Ceylanicis congruens), Sikkim, *J. D. Hooker*! (No. 607).

Habitu staturaque *P. imbricatulæ,* foliis autem minus hastatis et cellulis longioribus basi non quadratis sed oblongis, perichætialibus subulatis et peristomio interno, e fragmentis, lævi. *Theca* pro plantula satis magna. *Substantia* tenera.

8. P. IMBRICATULA (*Mitten*). Dioica, caule brevi, foliis imbricatis erectis ovatis breviter lanceolatis sensim angustatis non acuminatis nervo excurrente marginibus recurvis serrulatis, cellulis basi quadratis superne oblongis distinctis, perichætialibus longioribus subulato-attenuatis, theca in pedunculo elongato horizontali gibba plicata, operculo breviter conico, peristomio dentibus brevibus latiusculis interno ciliis nullis processibus apice striatulis, sporis reniformibus, flore masculo foliis perigonialibus ovatis subulatis.

Bartramia Griffithiana ex parte, et B. tenella, *Wils. in Sched.*

Hab. In Ceylon, *Gardner*! (No. 609, 613, 616).

P. filiformi statura colore dispositioneque foliorum affine, sed foliis basi ad angulos cellulis abbreviatis quadratis superioribus oblongis.

9. P. laxissima. (Bartramia, *C. Müller, Syn.* i. p. 480.)

Hab. In Assam, *Griffith*!

10. P. HETEROPHYLLA (*Mitten*). Dioica, cæspitosa, gracilis, foliis patentibus e basi oblonga lanceolatis nervo excurrente dorso marginibusque recurvis argute serrulatis, cellulis conformibus basi parum

latioribus oblongis teneris pellucidis, perichætialibus e basi late ovata longe subulatis, theca in pedunculo gracili globosa gibba plicata, operculo convexo breviter conico, peristomio dentibus brevibus interno processibus apice punctulatis ciliis rudimentariis, planta mascula foliis ovalibus obtusiusculis nervo vix excurrente, perigonialibus e basi suborbiculari subulato-lanceolatis erectis.

Bartramia tenella, var., *Wils. in Sched.*

Hab. In Ceylon, *Gardner* (No. 616) *et Thwaites*?

A *P. tenella,* si synonymon *P. filiformis* verum sit, distinctissima, et *P. laxissimæ* similis, sed foliis angustioribus longioribus lanceolatis tenuiter acuminatis argutius serrulatis. Forma foliorum caulinorum plantæ masculæ iis *Bryi albicantis* similis.

11. P. macrocarpa. (Bartramia, *C. Müller, Bot. Zeit.* 1853, p. 57.)

Hab. In mont. Nilghiri, *Schmid.*

12. P. NITIDA (*Mitten*). Dioica, *B. Turnerianæ* similis, sed foliis patentibus lanceolatis planis nervo angusto excurrente apice læviusculo marginibus serrulatis inferne anguste recurvis, cellulis omnibus elongatis angustis perichætialibus e basi ovata subulatis, theca in pedunculo elongato gracili rubro globosa gibba inclinata plicata, operculo convexo mammillato, peristomio in speciminibus immaturis normali?

Bartramia nitida, *Wils. l. c.* p. 370.

Hab. In Himalayæ boreali-occident. reg. temp., *Royle*! *et T. Thomson*! (No. 561).

P. Turnerianæ statura habituque maxime sinilis, sed foliis siccitate strictis patentibus haud appressis et seriatis, minus obscuris subnitentibus, cellulis angustis longioribus.

13. P. Turneriana. (Bartramia, *Schw.* t. 238. — Bartramia fontana *β.* marchica, *Griff. Not.* p. 437.—B. nitida, *Wils. in Sched.* quoad No. 561.)

Hab. Per Himalayæ reg. temp., Sikkim, vulgaris, *J. D. Hooker*! (No. 561, 563, 565, 569, 575, 576, 577, 582, 583, 598, 599, 600, 601, 616, 617). In Nepal, *Wallich*! Kumaon et Simla, *Strachey et Winterbottom*! *T. Thomson*! (No. 561). In mont. Khasian., ad Boga Panee, *Griffith*!

A *P. falcata*, quacum foliis seriatis convenit, nervo longe in acumen piliforme attenuato distinguenda.

14. P. pseudofontana (Bartramia, *C. Müller, Bot. Zeit.* 1856, p. 418).

Hab. In mont. Nilghiri, *Schmid*!

Ex descriptione, a *P. Turneriana* non discrepat.

15. P. falcata. (Bartramia, *Hook. Trans. Linn. Soc.* ix. t. 27.—B. gonioclada, *Wils. l. c.* p. 369.—B. angustata ex parte, *ejusd. l. c.*)

Hab. In Himalayæ, reg. temp., Sikkim, *J. D. Hooker*! (No. 602).

Nepal, *Wallich*! Kumaon, *Strachey et Winterbottom*! *T. Thomson*! (No. 618); et Tibet. occ. reg. temp., *T. Thomson*! (No. 562, 567, 604). Mont. Nilghiri, *Perrottet*!

Species foliis imbricatis in seriebus quinque dispositis sensim a basi angustatis nec ovatis nec acuminatis, nervo profunde carinatis et cellulis oblongis omnibus fere conformibus distinctis, facillime a consimilibus distinguenda. A *P. Marchica*, quacum fere omnibus partibus cellulisque convenit, foliis profunde carinatis et seriatis recedere videtur.

Obs. Adest species quædam Europæa hactenus prætervisa, *P. falcatam* dispositione foliorum seriata valde simulans, quamvis quoad formam *P. fontanæ* affinior.

16. P. SERIATA (*Mitten*). Dioica, *P. fontanæ* simillima, foliis erectis subfalcatisve imbricatis in apicibus ramorum seriatis late ovatis acuminatis nervo crasso in apice evanido margine serrulato inferne revoluto, cellulis basi parvis brevioribus subobscuris.

Bryum lycopodiiforme, *Schleich. MSS.*

Hab. In Helvetia, *Schleicher*! sterilis. In Britannia boreali in monte Ben-na-Bourd, *W. Gardiner*!

Specimina Schleicheriana sterilia (forma adventitia) innovationes breves foliis julaceo-imbricatis spicis *Lycopodii annotini* instar produnt. Species quamvis *P. fontanæ* valde affinis, structura foliorum partis inferioris certe distincta.

17. P. fontana, *Brid.* (Bartramia crassinervis, ex parte, *Wils. in Sched.*)

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 586). In Tibet. occid. reg. temp. et alp., *T. Thomson*! (No. 559, 564, 568, 606).

18. P. calcarea. (Bartramia, *Bruch et Schimp.*—Bartramia crassinervis, ex parte, *Wils. l. c.* p. 370.)

Hab. In Tibet. occid. reg. temp., *T. Thomson*! (No. 606, 618). In Himalaya boreali-occident., *Royle*!

Species nervo crassiore et cellulis amplioribus a *P. fontana* facile discernenda.

19. P. LUTEA (*Mitten*). Dioica, cæspitosa, caule elongato ramoso inferne fusco tomentoso, foliis erecto-patentibus subsecundis late ovatis basi biplicatis acumine lanceolato nervo tenuiusculo excurrente margine recurvo basi reflexo serrulato, cellulis superne elongatis angustis basi parum latioribus, perigonialibus e basi latissima laxa erecta breviter acuminatis acutis patulis.

Bartramia uncinata, *Wils. l. c.* p. 370.—B. crassinervis, ex parte, *ejusd. l. c.* p. 370.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 578, 579, 584, 587).

Habitu staturaque *P. fontanæ* et *P. calcareæ* similis, a priore foliis

mollibus tenerioribus, cellulis distinctioribus, nervo angustiore et ambitu longiore; a secundo, cellulis magis affinis, nervo autem longe angustiore statim dignoscitur. A *P. uncinata* longe diversa.

20. P. SPECIOSA (Bartramia, *Griff. Not.* p. 439; *Icon. Plant. Asiat.* ii. t. 101. f. 1). Dioica, cæspitosa, caule brevi, foliis laxis patentibus concavis ovato-lanceolatis apice semitortis nervo tenui excurrente carinatis marginibus basi tantum recurvis minute serrulatis, cellulis angustissimis elongatis ad angulos paucis oblongis, perichætialibus lanceolato-subulatis, theca in pedunculo elongato globosa gibba inclinata plicata, peristomio dentibus brevibus interno processibus apice punctulatis ciliis duobus irregularibus interpositis.

Hab. In mont. Khasian. in ripis arenosis, *Griffith*! In Nepal, *Wallich*! *Rami steriles* sesquiunciales crassiuscule plumosi, foliis siccis humidisque patentibus; *fertiles* breves semunciales, pedunculo unciali. *Theca* magna.

Species distinctissima crassitudine ramorum, *Bartramiæ tomentosæ* similis.

21. P. longicollis, *Hampe.* (B. Hookeri, *Wils. l. c.* p. 369.—B. dicranoidea, *ejusd. l. c.* p. 369.)

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 580, 581, 583, 585, 594).

5. BREUTELIA, *Schimp.*

1. B. INDICA (*Mitten*). Caule elato ramoso tomentoso, foliis nitidis e basi erecta subquadrata superne dilatata divaricatis subulato-lanceolatis acuminatis inferne plicis angustis exaratis apice subtortis nervo tenui excurrente marginibus serrulatis, cellulis basi utrinque ad latera majoribus in serie unica dispositis cæterum omnibus conformibus angustis elongatis papillosis, perichætialibus erectis apice latioribus nervo evanescente, theca in pedunculo brevi apice curvato globoso-pyriformi plicata horizontali.

Hab. In mont. Nilghiri, *Gardner*. In Himalayæ orient. reg. alp. (forma minor foliis magis deflexis = *B. deflexa*, Wils. in Sched.), Sikkim, *J. D. Hooker*! (No. 592).

B. giganteæ ex icone Schwægr. similis, sed foliis densioribus. *Pedunculus* trilinearis gracilis. *Peristomium*, quantum in thecis vetustis observari potest, normale.

2. B. dicranacea. (Bartramia, *C. Müller, Bot. Zeit.* 1853, p. 57.)

Hab. In mont. Nilghiri, *Schmid*!

Structura foliorum, e descriptione, a *B. Indica* diversa.

§ IX. Bryaceæ.

Mielichoferiacaceæ et Bryaceæ ex parte, *Schimp. Corol.*

1. Orthodontium, *Schw.*

1. O. infractum, *Dozy et Molk. Musc. Archipel. Ind.*, fasc. ii. p. 34, t. xiv.

Hab. In Ceylon, *Maxwell*!

2. Mielichoferia, *Hornsch.*

1. M. Himalayana (*Mitten*). Dioica, cæspitosa, caule elongato dichotomo inferne fusco-radiculoso, foliis patentibus inferioribus lanceolatis ovato-lanceolatisve nervo excurrente mucronatis margine apice parce denticulatis, superioribus latioribus in planta mascula ovatis, nervo excurrente piliformi, marginibus angustissime reflexis, cellulis laxis flaccidis, perichætialibus parum longioribus, theca in pedunculo breviusculo pyriformi, operculo convexo-conico, peristomio dentibus angustissimis hyalinis, flore masculo capituliformi foliis internis brevibus.

Hab. In Himalaya occidentali temperata, Kumaon ad Pindari, alt. 11,000 ped., *Strachey et Winterbottom*!

M. nitidæ var. *compactæ* statura similis, sed foliis flaccidioribus angustioribus cellulis elongatis.

Obs. Muscus ex Himalayæ orient. reg. temp., *J. D. Hooker*! (No. 471), fortasse species alia hujus generis est.

3. Webera, *Hedw.*

1. W. elongata. (Bryum, *Dicks.*)

Hab. In Himalayæ reg. temp. et alp., Nepal, *Wallich*! Sikkim, *J. D. Hooker*! (No. 474, 475, 476, 478, 479, 484, 485, 486, 488, 489, 491, 503, 544, 549 *b*, 550, 554), Simla, &c., *T. Thomson*! (No. 494, 504, 549).

2. W. polymorpha, *Schimp.*

Hab. In Himalayæ orient. reg. temp. et alp., Sikkim, *J. D. Hooker*! (No. 442, 469, 556).

3. W. rigescens (*Mitten*). Dioica? caule erecto, foliis patentibus e basi latiuscula subulato-lanceolatis, margine basi decurrente fere ad apicem acutum reflexo integerrimo denticulatove, nervo crassiusculo rubro excurrente, cellulis elongatis angustis, perichætialibus erectis apice angustioribus.

Bryum rigescens, *Wils. l. c.* p. 366.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 443).

W. elongata robustior, foliis basi latioribus sensim subulato-lanceolatis et margine ad apicem reflexo distincta.

4. W. HIMALAYANA (*Mitten*). Monoica, caule elongato cæspitoso innovationibus ramoso, foliis inferioribus innovationumque patentibus ovatis acutis, nervo subexcurrente, marginibus apice indistincte parce denticulatis a basi ad axillam folii inferioris utrinque decurrentibus, cellulis elongatis chlorophyllosis subindistinctis comalibus duplo longioribus lanceolatis apice latiusculis margine a basi ad ultra medium reflexo apice serrulatis, nervo excurrente, theca in pedunculo elongato claviformi subarcuata, peristomio *Pohliæ* ciliis carentibus, flore masculo in innovatione terminali vel repetitione innovationis laterali foliis exterioribus caulinis similibus interioribus orbiculatis concavis apiculo brevi terminatis.

Bryum acuminatum, *Wils. l. c.* p. 332.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* ! (No. 477).

W. elongatæ et *W. acuminatæ* habitu staturaque affinis, sed ab utraque foliis cellulis fere dimidio brevioribus marginibus decurrentibus et floris masculi structura diversa.

5. W. flexuosa. (Pohlia, *Hook.*—Brachymenium microstomum, *Harvey, Hook. Icon. Plant. Rar.* t. 19. f. 4.)

Hab. In Himalayæ orient. et cent. reg. temp., Nepal, *Wallich* ! Sikkim, *J. D. Hooker* ! (No. 495, 496, 497, 498, 525).

6. W. DELICATULA (*Mitten*). Dioica? caule erecto sub perichætio innovante, foliis laxis patentibus ovato-lanceolatis apice acuminatis acutis, nervo excurrente, margine superne remote serrulato a basi ad folii inferioris axillam decurrente, cellulis elongatis angustis, perichætialibus erectis longioribus, theca in pedunculo elongato gracili obovata flexura colli abrupte pendula, operculo conico acuminato, peristomio *Pohliæ*.

B. delicatulum, *Wils. l. c.* p. 332.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* ! (No. 481, 483). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* ! (No. 509).

W. annotinæ et W. albicantis formis gracilioribus similis, sed theca abrupte inclinata.

7. W. albicans. (Bryum, *Wahl.*)

Hab. Var. *speciosa*, In Tibet. occid. reg. alp., *T. Thomson* ! Var. *glacialis*, in Tibet. occid. et in Himalayæ boreali-occident. reg. temp., *T. Thomson* ! (No. 402, 406, 407, 421).

8. W. pyriformis, *Hedw.*

Hab. In Tibet. occid. reg. temp., *T. Thomson* ! (No. 448).

9. W. cruda, *Schw.*, *Griff. Icon. Plant. Asiat.* ii. t. 91. f. 4.?

Hab. In Himalayæ orient. reg. temp. et alp., Sikkim, *J. D. Hooker* ! (No. 499). In mont. Khasian., in pinetis ad Moflong, *Griffith* ?

Anne planta Griffithiana species vera sit, an potius ad *W. elongatam* pertinens speciminibus non visis non dijudicare volui.

4. Bryum, *Dill.*

1. B. filiforme (*Mitten*). Dioicum, caule innovante ramoso gracili, foliis erectis aureo-nitidis filiformi-imbricatis late ovatis concavis apice obtusiusculis acutis subcrenulatis integerrimisve, nervo ad $\frac{3}{4}$ evanido, cellulis basi et ad folii tertiam partem longitudinis laxis amplis superioribus angustissimis elongatis, perichætialibus superne angustioribus, theca in pedunculo gracili elongato elliptica erecta horizontalive, operculo brevi conico, peristomio *Brachymenii.*

Brachymenium filiforme, *Griff. Not.* p. 443; *Icon. Plant. Asiat.* ii. t. 102. f. 2.

Hab. In mont. Khasian., *Griffith* ! In reg. temp., *J. D. Hooker et T. Thomson* ! (No. 522, 523, 536, 539). In Himalayæ reg. temp., Sikkim, *J. D. Hooker* ! (No. 518, 535). Nepal, *Wallich* ! Kumaon, *Royle* !

Statura *B. julaceo* et *B. prostrato* intermedia. *Color* pulchre aureonitens.

2. B. auratum (*Mitten*). Dioicum, cæspitosum, caule foliis erectis arcte imbricatis filiformi julaceo, foliis suborbiculatis obtusiusculis concavis nervo tenui ad $\frac{3}{4}$ evanido integerrimis apice tantum suberosis, cellulis basi laxis amplis sensim superne angustatis, perichætialibus ovatis triangularibus obtusiusculis, theca in pedunculo elongato gracili horizontali angusto-elliptica, operculo conico-rostrato, peristomio dentibus rubris interno processibus angustis brevibus rudimentariis in membrana alte exserta.

Brachymenium filiforme, ex parte, *Wils. l. c.* p. 363.

Hab. In Himalaya centrali et orientali, Nepal, *Wallich* ! *J. D. Hooker* ! (No. 513, 519).

B. filiformi primo adspectu maxime simile, sed foliis fere duplo latioribus cellulis ad eorum apices duplo triplove latioribus et operculo rostrato.

3. B. nitidum (*Mitten*). Dioicum, caule simplici tereti, foliis erectis imbricatis late ovatis acutis concavis nervo in mucronem parvulum excurrente integerrimis, cellulis basi laxis sensim superne angustioribus apice angustis flexuosis, perichætialibus angustioribus, theca in pedunculo elongato cernua oblonga macrostoma, peristomio dentibus longiusculis interno normali *Bryi* in membrana altiuscula.

Hab. In Himalayæ reg. temp., Sikkim (inter cæspites *Anthocori tuberculati*), *J. D. Hooker* ! Simla, *T. Thomson* ! Inter muscos varios fragmenta carpsi.

Habitu staturaque *B. filiformi* non dissimile, foliis tamen mollioribus minus arcte julaceo-imbricatis.

4. B. Weissiæ. (Brachymenium, *Hook.*—B. bryoides, *Schw.* t. 135.—Bryum exile, *Dozy et Molk. Musc. Archip. Ind.* t. 5.—B. Nepalense *Spreng.*, *C. Müller, Synops.* i. p. 311.)

Hab. In Himalayæ reg. temp., Nepal, *Wallich*! Simla, *T. Thomson*! (No. 524). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! et Nilghiri, *Perrottet*! *Schmid*!

5. B. Schmidii, *C. Müller, Bot. Zeit.* 1853, p. 24.

Hab. In mont. Nilghiri, *Schmid.*

6. B. Harveyanum, *C. Müller, Synops.* i. p. 313. (Brachymenium acuminatum, *Harvey.*—B. cuspidatum, *Griff. Not.* p. 442; *Icon. Plant. Asiat.* t. 102. f. 1.)

Hab. In Penang, *Wallich*! In mont. Khasian., ad Myrung, *Griffith*; in reg. temp. (B. *Weissiæ*, consociatum), *J. D. Hooker et T. Thomson*! (No. 521). In mont. Nilghiri, *Schmid*!

De planta Griffithiana non omnino certus sum, sed ex icone et descriptione huc referenda est.

7. B. flaccidisetum, *C. Müller, Bot. Zeit.* 1853, p. 23.

Hab. In mont. Nilghiri, *Schmid*!

E. descriptione vix a *B. Harveyano* differt.

8. B. MICANS (*Mitten*). Dioicum? caule brevi tereti, foliis imbricatis ovatis acutis nervo luteo latiusculo sub apice evanido vel in cuspidulam excurrente margine superne serrulatis, cellulis basi et pro tertia folii longitudinis parte laxis suboblongis cito in angustas superne subflexuosas transeuntibus, perichætialibus e basi latiore lanceolatis structura conformibus, theca in pedunculo elongato flexuoso *B. Weissiæ*, annulo composito, peristomio *Brachymenii*? operculo conico-obtuso.

Hab. In India orientali, *Greville* (in Herb. *Gardner*!).

B. Weissiæ habitu adspectuque simile, structura autem foliorum diversum.

B. nitido foliis minus concavis serrulatis, et theca peristomioque *Brachymenii*? Peristomium internum non inveni.

A *B. filiformi* et affinibus foliis acutis refugit.

9. B. EXTENUATUM (*Mitten*). Synoicum, cæspitosum, caule humili ramoso, foliis patentibus laxe imbricatis ovali-acuminatis concavis nervo in mucronem excurrente margine integerrimis indistincteve dentatis, cellulis laxiusculis marginalibus uni- vel biseriatis angustis, perichætialibus longioribus lanceolatis rigidis, theca in pedunculo elongato ovali erecta, operculo conico-curvirostrato brevi, peristomio *Brachymenii* processibus angustis, annulo lato composito.

Hab. Carnatic ad Negapatam, *Wight*!

B. Weissiæ proximum, foliis autem longioribus et inflorescentia synoica diversum.

10. B. argenteum, *Linn.*

Hab. In Himalayæ totius reg. temp. et alp., Nepal, *Wallich*! Sikkim, *J. D. Hooker*! (No. 470, 517, 537, 541, 542, 543, 554, 555). Simla, *T. Thomson*! (No. 540? 546, 552). In Ceylon, *Gardner* (No. 511, 514, 515, 533, 534). In mont. Nilghiri, *M'Ivor*! *Gardner*! *Schmid*! In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! (No. 520).

11. B. ALBULUM (*Mitten*). Dioicum? albidum, caule brevi, foliis compacte imbricatis quinquefariis ovatis apice obtusiusculis nervo paulo ultra medium evanido integerrimis, cellulis in folii dimidio inferiore parvis oblongis subparallelogrammaticis pallide viridibus, in dimidio superiore elongatis acutis laxis hyalinis, perichætialibus ovato-lanceolatis, theca in pedunculo elongato rubro brevi-ovali pendula basi rugosa, peristomio *Bryi*? processibus in membrana altiuscula.

Hab. In peninsula Indiæ orient., *Greville* (in Herb. *Gardner*!).

Color glauco-albidus. Habitu staturaque *B. argentei*, a quo et affinibus foliis quinquefarie dispositis satis recedit. *Pedunculus* uncialis sesquiuncialisque, crassiusculus, rubro-fuscus.

12. B. coronatum, *Schw.*

Hab. In Nepal? *Wallich*! In Ceylon, *Gardner* (No. 432, 433).

Specimina ex Java accepi sub nomine *B. dolioli*, Duby; sed in his et Indicis peristomium internum ciliis appendiculatis et florescentia dioica a forma Americæ meridionalis non discrepant.

13. B. hemisphæricarpum, *C. Müller, Synops.* ii. p. 576.

Hab. In Himalayæ reg. temp., Nepal, *Wallich*! Sikkim, *J. D. Hooker*! (No. 464). Kumaon, *Strachey et Winterbottom*!

14. B. COGNATUM (*Mitten*). Synoicum, habitu staturaque *B. sanguinei*, foliis latioribus, cellulis duplo latioribus utriculo primordiali serpentino repletis, peristomio interno processibus late pertusis ciliis in unum coalitis valde appendiculatis in membrana ad dentium dimidium exserta, annulo lato composito.

Hab. In Ceylon, *Gardner*! (No. 512). Nudo oculo *B. sanguineo* persimile, sed florescentia peristomio et structura foliorum distinctum.

15. B. rubens, *Mitten in Hook. Journ. of Bot.* 1856, p. 232.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 427, 482). In Assam, *Griffith*!

16. B. Montagneanum, *C. Müller, Synops.* i. p. 265.

Hab. In mont. Nilghiri, *Perrottet*! *Schmid*!

17. B. rugosum, *C. Müller, Bot. Zeit.* 1853, p. 23.

Hab. In mont. Nilghiri, *Schmid*.

18. B. pachytheca, *C. Müller, Synops.* i. p. 307.

Hab. India orientalis (Herb. *Gottsche.*).

19. B. FULVELLUM (*Wils. l. c.* p. 330). Dioicum, pusillum, cæspi-

tosum, caule brevissimo innovationibus pluribus ramoso, foliis patentibus ovatis, nervo in acumen longiusculum excurrente, marginibus subintegerrimis, cellulis inferne elongatis angustis superne subflexuosis, perichætialibus ovato-lanceolatis, theca in pedunculo gracillimo rubro ovata microstoma pendula, operculo parvo conico, peristomio *Ptychostomi*, annulo composito.

Hab. In Himalayæ orient. reg. alp., Sikkim, *J. D. Hooker*! (No. 439).

Species parvula pulchella. *Caulis ramique* altitudine lineari. *Folia* lutescentia. *Pedunculus* 4–8-linearis. *Theca* parva pallide fusca. Structura peristomii *B. cernuo* simile, sed foliorum structura aliena, et *Bryis B. Weissiæ* similibus affinius.

20. B. ERYTHRINUM (*Mitten*). Dioicum, caule breviusculo ramoso, foliis patentibus anguste ovatis lanceolatis concavis, nervo rubro in mucronem brevem excurrente, margine integerrimo apiceve parce denticulato, cellulis laxis amplis marginalibus in serie unica angustis, perichætialibus lanceolatis, theca in pedunculo elongato horizontali pendula vel clavata, ore magno, operculo conico, peristomio *Bryi*.

B. pachypoma, *Wils. l. c.* p. 364, ex parte.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 473, 535).

Color totius plantæ ruber, apicibus ramorum tantum subviridibus. *Folia* siccitate appressa nitoris destituta, ambitu angusto illis *B. sanguinei* similia, sed cellulis multo laxioribus. Theca *B. sanguinei*, sed ore majore. A *B. rubente* foliis angustioribus magis ovato-lanceolatis margine tenuiore et cellulis longioribus recedit.

21. B. porphyrioneuron, *C. Müller, Bot. Zeit.* 1853, p. 22.

Hab. In mont. Nilghiri, *Schmid*.

22. B. nitens, *Hook. Icon. Plant. Rar.* t. 19. f. 6. (B. pachypoma, *Mont.*—B. apiculatum, *Schw. Supp.* t. 72.—B. coronati var., *Wils. l. c.* p. 333.)

Hab. In Nepal, *Wallich*! In Ceylon, *Gardner*! (No. 431). Etiam in Java (Hb. *Miquel*).

Icon Hookeri supra citata mala, quod folia e musco alieno desumpta. Species, neglecta foliorum structura, cum *B. alpino* commutata, cellulis autem longioribus, marginalibus vix serie unica distincta, certe aliena, præterea statura minore et pedunculi flexura late arcuata.

23. B. alpinum, *Linn.* (B. teretiusculum, *Hook. Icon. Plant. Rar.* t. 20. f. 1.—B. pachypoma, *Wils. l. c.* p. 364, ex parte.)

Hab. In Himalayæ tot. reg. temp., Nepal, *Wallich*! *J. D. Hooker* (No. 430, 490); Sikkim, *J. D. Hooker* (No. 429, 436, 447, 453, 468, 480, 500, 530). Simla et Kishtwar, *T. Thomson*! (No. 452, 461). In Tibet. occid. reg. temp., *T. Thomson*! (No. 454). In mont. Nilghiri, *M'Ivor*. In collibus Jyntea, *J. D. Hooker et T. Thomson*! (No. 435). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! (No. 434, 478).

Foliorum forma et structura speciminum Indicorum omnibus notis cum planta Europæa conveniunt. *Theca* interdum collo brevi = *B. teretiusculum*. *Folia* minime variant neque forma neque cellularum structura, margine basi utrinque decurrente, cellulis basi ad nervum in foliis vetustioribus fusculis pro spatio brevi protractis, qua nota per variationes omnes distinguitur.

24. B. cernuum, *B. et S.* (B. fulvellum, ex parte; B. pumilum; B. subrotundum; B. pallescens, var.; B. viridans; B. inclinatum, var., et B. intermedium, var., *Wils. l. c.* pp. 330, 331.)

Hab. In Himalayæ reg. temp. et alp., Sikkim, *J. D. Hooker*! (No. 438, 440, 441, 444, 445, 446, 462, 463, 501, 502). Simla, *T. Thomson*! (No. 180, 440 *b*, 449, 451, 453, 465).

Hæc omnia supra enumerata ad speciem unam parum variantem reduxi. *Florescentia*, ut mos est muscorum monoicorum, sæpe confluentia florum synoica. Specimina floribus masculis in ramulo proprio segregatis e montibus Helvetiæ in summo montis Gemmi, a cl. Schimper accepi, et in Britannia ipse legi, floribus autem fertilibus absque antheridiis non observavi. Species, ut specimina plura elucent, per totam hemisphæram borealem plana et alpina usque ad regiones ulteriores arcticas adscendens. *Peristomium* tantillum variat, nunc interno externo omnino adglutinato, nunc fere libero.

25. B. lacustre, *Brid.* (B. fulvellum, ex parte, *Wils. l. c.* p. 330.)

Hab. In Himalayæ orient. reg. alp., Sikkim, *J. D. Hooker*! (No. 428).

26. B. calophyllum, *Brown.* (B. latifolium, *Bryol. Europ.*—B. pallens, var., *Wils. l. c.* p. 366.)

Hab. In Tibet. occid. reg. temp., *T. Thomson*! (No. 426).

Specimina hæc ab originalibus, foliis breviter nervo excurrente apiculatis, discrepant, cæterum aspectu plantæ in statu sicco et structura foliorum omnino conveniunt. Observationes inter *B. calophyllum* et *B. Warneum*, si in loco natali unum in alterum transeat, desiderantur. A *B. pallente* florescentia jamjam distincta.

27. B. Warneum, *Bland.*

Hab. In Himalayæ occidentalis reg. temp., Kumaon, *Strachey et Winterbottom.*

28. B. cæspiticium, *Linn.*, *Griff. Icon. Plant. Asiat.* ii. t. 91. f. 5. (B. pachypoma, ex parte, *Wils. l. c.* p. 364.)

Hab. In Himalayæ boreali-occident. reg. temp., Simla, *T. Thomson* (No. 418, 425, 437, 450, 455, 457). Kashmir, *T. Thomson* (No. 493). In mont. Khasian., ad rupes et arborum truncos (an species vera?), *Griffith.*

29. B. lamprostegum, *C. Müller, Bot. Zeit.* 1853, p. 22.

Hab. In mont. Nilghiri, *Schmid.*

30. B. subrotundum *Brid.* (B. pumilum, ex parte; B. cæspiticium, et B. cernuum, *Wils. l. c.* p. 331.)

Hab. In Himalayæ occidentalis reg. temp., Jamu, *T. Thomson* (No. 466); et in Tibet. occid. reg. alp., *T. Thomson* ! (No. 431, 467).

Peristomium, in specimine No. 467, ciliis appendiculatis *Bryi* !

31. B. Tibetanum (*Mitten*). Monoicum, compacte cæspitosum, humile, *B. cæspiticio* simillimum, foliis late ovatis ovato-lanceolatisque acutis acuminatisve nervo in mucronem brevem excurrente marginibus apicem versus subserrulatis inferne subrecurvis, cellulis inferioribus oblongis superioribus prosenchymaticis, perichætialibus brevioribus orbiculari-acuminatis, theca in pedunculo elongato pendula ei *B. cæspiticii* simili, operculo conico, peristomio interno processibus e ciliis in unum coalitis æquilongis lævibus in membrana ad dimidium fere dentium exserta, annulo composito, flore masculo in ramulo terminali.

B. cæspiticium, *Wils. l. c.* p. 332.

Hab. In Tibet. occid. reg. temp., *T. Thomson* ! (No. 458).

Habitu staturaque *B. cæspiticii,* florescentia autem *B. pallescentis.*

32. B. exstans (*Mitten*). Synoicum, caule breviusculo, foliis patentibus inferioribus ovalibus superioribus ellipticis lanceolatisve acuminatis nervo sub apice evanido vel excurrente margine apice vix dentato, cellulis laxis marginalibus duplici-seriatis angustis elongatis ætate infuscatis, perichætialibus longioribus, theca in pedunculo elongato inclinata horizontali pyriformi inæquali, ore amplo, peristomio normali.

Hab. In Tibet. occid. reg. temp., *T. Thomson* ! (No. 456), et forma sterilis in reg. alp. (No. 419).

B. pallenti forma foliorum simile, quamvis folia e medio ad apicem formam magis acuminatam ostendunt. Planta fructifera thecis inclinatis horizontalibusve, primo visu *Funariæ Muhlenbergii* subsimilis.

33. B. cellulare, *Hook., Schw. Supp.* t. 214.

Hab. In Nepal, *Wallich* !

34. B. splachnoides (Brachymenium, *Harvey.*—Pohlia turbinata, *Schw.* t. 194 ?)

Hab. In Nepal, *Wallich* !

35. B. flaccum (*Wils. l. c.* p. 332). Dioicum ? caule innovationibus ramoso, foliis patentibus laxis flaccidis ellipticis piliformi-acuminatis nervo tenui ultra medium evanido margine integerrimo apiceve denticulo uno alterove instructis, cellulis laxis mollibus marginalibus paululum longioribus, perichætialibus angustioribus, theca in pedunculo flexuoso oblonga subelliptica inclinata horizontalive, operculo conico-acuminato, peristomio *Pohliæ* ciliis brevissimis rudimentariis, flore masculo in ramulo terminali foliis interioribus brevibus lanceolatis.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* ! (No. 487).

Folia flaccida. Formis flaccidioribus *B. pallentis* simile, sed theca

B. acuminati. Flores masculi in ramis gracilibus inter plantas fœmineas inveni, an et ex parte inferiore caulis fœminei egrediente determinare non possum.

36. B. Thomsoni (*Mitten*). Dioicum, cæspitosum, caule elongato ramoso, foliis erecto-patentibus elliptico-lanceolatis nervo excurrente cuspidatis margine apice parce denticulato subintegerrimo, cellulis teneris laxiusculis marginalibus angustis triplici serie dispositis, perichætialibus conformibus, theca in pedunculo gracili pyriformi cernua, operculo convexo conico, peristomio interno processibus perforatis ciliis brevibus rudimentariis in membrana altiuscule exserta, annulo composito.

B. cuspidatum, ex parte, *Wils. l. c.* p. 364.

Hab. In Tibet. occid. reg. temp., *T. Thomson*! (No. 401).

Primo visu *B. turbinato* var. *Schleicheri* simile, sed foliis angustis longe cuspidatis. *B. alpino* affinius, cellulis tamen latioribus longioribusque basi latioribus sed non ad nervum aggregatis.

37. B. pseudotriquetrum, *Hedw.* (Bryum *B. bimo* affine, *Wils. l. c.* p. 366.)

Hab. In Tibet. occid. reg. temp., *T. Thomson*! (No. 399, 408, 409, 409 *b*).

Specimina sterilia, formis tamen Europæis omnibus partibus convenientia.

38. B. turbinatum, *Hedw.* (B. cuspidatum ex parte, B. distans et B. appressum, *Wils. l. c.* pp. 364, 365.)

Hab. In Tibet. occid. reg. temp. et alp., *T. Thomson*! var. *a.* (No. 410, 410 *b*, 415, 416, 417); var. *Schleicheri* (No. 405, 414, 423); et *H. Strachey* (No. 403). In Kumaon, *Strachey et Winterbottom*; var. *latifolium*, *T. Thomson*! (No. 400, 412, 420).

39. B. Nepalense. (Brachymenium, *Hook.*—B. Hookeri, *Spreng.*—B. brevicaule, *Hampe*?—B. contortum, *Griff. Not.* p. 440; *Icon. Plant. Asiat.* ii. t. 100. f. 2.)

Hab. In Himalayæ tot. reg. temp., Nepal, *Wallich*! Sikkim, *J. D. Hooker* (No. 506, 507, 508, 521, 526, 527, 528, 548, 551). Kumaon, *T. Thomson* (No. 505). In mont. Khasian. in arboribus in pinetis Moflong, *Griffith*! In Ceylon, *Thwaites*!

Species varians thecis erectis et interdum fere pendulis, sed structura foliorum et florescentia monoica constans.

40. B. clavariæformis, *C. Müller, Bot. Zeit.* 1853, p. 24.

Hab. In mont. Nilghiri, *Schmid.*

E descriptione a *B. Nepalensi*, florescentia dioica excepta, vix diversum videtur.

41. B. velutinum, *C. Müller, Bot. Zeit.* 1853, p. 33.

Hab. In mont. Nilghiri, *Schmid*! Ad Madras, *Wight*!

42. B. leptostomoides, *C. Müller, Synops.* i. p. 321.
Hab. In mont. Nilghiri, *Perrottet*! *Foulkes*! *et Schmid*! Ad Madras, *Wight*!

43. B. torquescens, *B. & S.*
Hab. In Himalayæ occident. reg. temp., Kashmir, *T. Thomson*! (No. 460).

44. B. apalodictyoides, *C. Müller, Bot. Zeit.* 1853, p. 21.
Hab. In mont. Nilghiri, *Schmid.*

45. B. paradoxum, *Schw.* t. 224.
Hab. In Nepal, *Wallich*!

46. B. Zollingeri, *Duby.*
Hab. In Nepal, *Wallich*! In mont. Nilghiri, et in Ceylon, *Gardner*!

47. B. RECURVULUM (*Mitten*). Dioicum, cæspitosum, caule elongato, foliis erectis late ovalibus acuminatis apicibus patentibus nervo in mucronem excurrente margine anguste recurvis apice parce serrulato integerrimove, cellulis longiusculis marginalibus unica serie dispositis angustis vix conspicuis, perichætialibus interioribus ovatis, theca in pedunculo elongato pendula pyriformi, ore magno, operculo convexo-conico, peristomio normali, annulo lato composito.
Hab. In Nepal, *Wallich*!
B. Billardieri simile, sed foliis magis ovalibus vix serrulatis cellulis angustioribus. A *B. capillari* foliis margine vix distincto ubique recurvo satis distinctum.

48. B. WIGHTII (*Mitten*). Caule elongato subsimplici, foliis patentibus laxe imbricatis ovato-oblongis concavis apicibus patulis nervo in mucronem brevem excurrente margine fere ad apicem recurvo apice parce serrulato, cellulis basi angustis superne longitudine latitudinem triplo excedente utriculo primordiali repletis, marginalibus circiter sexseriatis angustis, perichætialibus ovato-lanceolatis, theca in pedunculo longissimo inclinata elongata clavata, peristomio normali.
B. strigosum, *Wils. l. c.* p. 366.
Hab. In India orient. *Wight*! In mont. Nilghiri, *Gardner*! *M'Ivor*! In Ceylon, *Gardner*! (No. 398).
B. erythrocauli et *B. densifolio* simile, foliis autem rigidioribus densioribus nitentibus siccitate tortis. A *B. ramoso* caulibus longioribus foliis æqualibus haud rosulatis siccitate minus contractis cellulis paululum minoribus et ambitu folii baseos magis ovato recedit. *Caulis* bi- triuncialis. *Folia* longitudine bilinearia, latitudine linearia.

49. B. MEDIANUM (*Mitten*). Dioicum, caule elongato-ramoso, foliis patentibus ellipticis nervo excurrente piliformi mucronatis marginibus inferne reflexis superne serratis, cellulis latis laxis utriculo primordiali dissoluto marginalibus triplici-seriatis, perichætialibus brevioribus

angustis, theca in pedunculo elongato pendula inæquali claviformi, operculo brevi conico, peristomio normali.

Hab. In mont. Nilghiri, *M'Ivor* ! In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 369), specimina sterilia.

B. ramoso simillimum, foliis autem ambitu ovali-ellipticis non obovatis, longius acuminatis et cellulis duplo majoribus.

50. B. giganteum, *Hook.* (B. Sollyanum, *Griff. Not.* p. 446; *Icon. Plant. Asiat.* t. 91. f. 1.)

Hab. In Himalayæ reg. temp., Nepal, *Wallich* ! Sikkim, *J. D. Hooker* ! (No. 392, 540). In sylvis Surureem et copiose in pinetis Moflong, *Griffith* ; et in mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 371 *b*, 391). In Ceylon, *Gardner* (No. 597).

51. B. roseum, *Schreb.* (B. Commersonii, B. Commersonii aff., B. species, B. Zollingeri et B. Nilghiriensi aff., *Wils. l. c.* p. 367.)

Hab. In Kumaon et Tibet. occid. reg. temp., *T. Thomson* ! (No. 393, 395). In Nepal, *Wallich* !

Specimina quamvis sterilia a *B. Commersonii* longe diversa et a planta Europæa non recedentia.

52. B. ramosum. (Mnium *Hook. Icon. Plant. Rar.* t. 20. f. 2.—Bryum Auberti, *Mont.*; inde B. Nilgiriense, *ejusd.*—B. truncorum, *Wils. l. c.* p. 366.)

Hab. In Nepal, *Wallich* ! In mont. Nilghiri, *Perrottet* ! *Schmid* ! *G. Thomson* ! (No. 394).

In icone l. c. theca inclinata repræsentata est, sed in speciminibus, utplurimum, pendula videtur. A *B. truncorum* cellulis paululum minoribus et margine angustiore recedit.

§ X. Hypnaceæ.

Fabroniaceæ, Hookeriaceæ, Orthotheciaceæ ex parte, et Hypnaceæ ex parte, *Schimp. Coroll.*

Pleurocarpica. *Folia* cellulis elongatis prosenchymaticis alaribus heteromorphis plus minus distinctis. *Peristomium* Bryacearum.

1. Fabronia, *Raddi.*

1. F. secunda, *Mont.*

Hab. In mont. Nilghiri, *Perrottet* !

2. F. Goughii (*Mitten*). Dioica? cæspitosa, caule repente, foliis laxis patentibus compressis anguste ovatis longe subulato-piliformi-acuminatis margine arcte sed breviter serratis, nervo tenui infra medium evanido, cellulis basi subquadratis superioribus elongatis, perichætialibus latioribus acumine breviore serratis, theca in pedunculo brevi erecta ovali, peristomio *F. secundæ*.

Hab. In mont. Nilghiri, ad arborum truncos, *Gough* !

F. secundæ affinis, sed foliis duplo latioribus, cellulis partis folii superioris angustioribus dimidio brevioribus, margine arctius serrato. A *F. pusilla* var. *major*, foliis dimidio angustioribus, serraturis brevibus, cellulis paululum minoribus, et apiculo longiore diversa. Florem masculum frustra quæsivi. An vere dioica?

3. F. Schmidii, *C. Müller, Bot. Zeit.* 1854, p. 558.
Hab. In mont. Nilghiri, *Schmid.*

4. F. MINUTA (*Mitten*). Monoica, cæspitosa, exilis, caule repente, ramis brevibus curvatis, foliis densis patentibus late ovatis in apiculum filiformem patulum recurvumque acuminatis margine breviter arcte serratis, nervo medio evanido, cellulis basi quadratis superioribus longioribus oblongis tenuiter limitatis, perichætialibus late ovatis minute serratis brevi apiculatis, theca in pedunculo brevi *F. pusillæ*, flore masculo ad pedem fœminei.

Hab. Himalayæ occid. reg. temp., Kumaon, alt. 7000 ped. (in thallode *Parmeliæ Borreri* repens), *T. Thomson*!

F. pusilla fere minor, foliis patentioribus latioribus margine non lobato sed eodem modo ac in *F. octoblepharoide* serrato, cellulis superioribus longitudine latitudinem duplo excedentibus oblongis parietibus angustis. A *F. pusilla* et *F. octoblepharoide*, quarum cellulæ longitudine latitudinem triplo superant parietibusque crassioribus gaudent, foliis densioribus apiculo incano squarrosis, discrepat.

2. HYPNUM, *Dill., Brid. et auct.* ex parte.

Leskea ex parte, *auct.*, Homalothecium, Isothecium ex parte, Brachythecium, Scleropodium, Eurynchium, Rynchostegium, Amblystegium, et Lescurea, *Schimp.*, Pterogonium ex parte, *auct.*
Folia uninervia.

* *Lescurea.*

Peristomium internum imperfectum.

1. H. LÆVIUSCULUM (*Mitten*). Monoicum, caule repente pinnato, ramis erectis teretibus, foliis imbricatis ovatis brevi acuminatis sensimve lanceolatis concavis nervo medio evanido margine paululum recurvo superne serrulato, cellulis elongato-ovalibus alaribus pluribus parvis quadratis pellucidis, perichætialibus erectis latis convolutis apicibus serrulatis, theca in pedunculo breviusculo pallido cylindrica erecta, operculo conico-acuminato, peristomio interno rudimentario externo adhærente, annulo composito.

Pterogonium neckeroides, *Griff. Not.* p. 450; *Icon. Plant. Asiat.* ii. t. 98. f. 3.

Hab. In mont. Khasian., ad Mumbree, in arboribus, *Griffith*!

Gracilis. *Caulis* repens, ramis circiter trilinearibus colore stramineo-fuscis. Habitu *Stereodontis prorepentis*, sed longe gracilius, areo-

latione foliorum *Rhegmatodontibus* approximans. *Theca* in pedunculo semunciali.

2. H. pterogonioides. (Leskea, *Hook. Icon. Plant. Rar.* t. 24. f. 8.)
Hab. In Himalayæ reg. temp., Nepal, *Wallich*! Sikkim, *J. D. Hooker*! (No. 739, 740, 741).

3. H. decorum. (Leskea longirostris, *Schw.* t. 290 *a.*)
Hab. In Nepal, *Wallich*!

4. H. fulvum. (Leskea fulva, *Harvey*; *Hook. Icon. Plant. Rar.* t. 23. f. 2.)
Hab. In Himalayæ reg. temp., Népal, *Wallich*! Sikkim, *J. D. Hooker*! (No. 758, 897).
Theca in pedunculo elongato erecta ovalis, operculo conico curvirostrato, peristomio interno processibus angustis dentium longitudine (eique adhærentibus ?) in membrana ad $\frac{1}{4}$ longitudinis exserta. *Color* pulchre fulvus nitidus, *Stereodonti russulo* similis.

5. H. ARGENTATUM (*Mitten*). Monoicum, dense cæspitosum, ramis erectis ramosis, foliis patentibus nitentibus ovatis sensim tenuiter acuminatis planiusculis nervo brevissimo margine remote serrulatis, cellulis elongatis teneris ad angulos laxioribus subquadratis concoloribus, perichætialibus erectis brevi-acuminatis serrulatis, theca in pedunculo rubro elongato magna ovata erecta siccitate sub ore contracta, operculo conico-acuminato, peristomio dentibus brevibus teneris, interno ?
Hab. In Himalaya occidentali, Kumaon, *Strachey et Winterbottom*!
Sericeo-argenteo-viridis, ramis erectis dense compacte cæspitosis semuncialibus inferne nudiusculis. *Pedunculus* subuncialis. Species primo visu *Brachymeniis* nonnullis (e. g. *B. velutino*) similis.

6. H. incompletum. (Leskea, *Griff. Not.* p. 478; *Icon. Plant. Asiat.* ii. t. 102. f. 3.)
Hab. In Assam, *Griffith.*

7. H. Bonplandii. (Leskea, *Hook.*—Hookeria Leskeoides, *ejusd. Musc. Exot.* t. 55.—Isothecium Nilgiriense, *Mont.*—Hypnum, *C. Müller, Synops.* ii. p. 462.—Pleuropus fenestratus, *Griff. Not.* p. 468; *Icon. Plant. Asiat.* ii. t. 90. f. 1; *Calcutta Journ. Nat. Hist.* iii. t. 18.)
Hab. In mont. Nilghiri, *Perrottet*! *Gough*! *Foulkes*! *Schmid*! In Assam, *Griffith*! In Ceylon, *Gardner*!
Inter specimina Indica et Americana necnon alia e Promontorio Bonæ Spei allata discrimen nullum inveni. Habitus *Hypni sericei.*

** *Brachythecium.*

Peristomium normale.

8. H. LONGICUSPIDATUM. Dioicum? caule procumbente pinnato, foliis imbricatis late ovatis concavis plicatis in apiculum elongatum angustum denticulatum subito attenuatis nervo ad medium evanido

margine parce serrulatis, ramis valde excavatis tenuissime plicatis, cellulis elongatis angustis alaribus paucis parvis oblongis, perichætialibus erectis lanceolatis tenuiter acuminatis, theca in pedunculo elongato ovali-cylindrica inclinata, operculo conico acuminato, peristomio normali.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker.*

H. cirrhoso valde simile, sed foliis in dimidio inferiore latioribus tenuioribus parcius plicatis diversum. Modus crescendi *H. salebrosi.*

9. H. CUSPIDIFERUM (*Mitten*). Dioicum? caule procumbente piunnato, foliis patentibus, caulinis latissime cochleariformibus subito in acumen tenue longum denticulatum attenuatis, nervo tenui medio evanido, ramis hastato-ovatis lanceolatis subintegerrimis, cellulis angustis circiter latitudine $\frac{1}{3000}$ longitudine $\frac{1}{500}$ unciæ metientibus alaribus pluribus parvis pallidis, perichætialibus e basi ovata enervi longe subulato-attenuatis, theca in pedunculo rubro lævi oblonga inclinata, operculo conico, peristomio dentibus flavidis processibus angustis æquilongis ciliis binis interpositis in membrana ad dentium tertiam partem exserta.

H. Buchanani, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 996).

Primo adspectu *H. Buchanani* simile, sed foliis caulinis profunde cochleariformibus subito in acumen angustum æquilongum attenuatis distinctissimum.

10. H. Buchanani, *Hook.*

Hab. In Himalayæ reg. temp., Nepal, *Buchanan*! *Wallich*! Sikkim, *J. D. Hooker* (No. 998). Kumaon, *Strachey et Winterbottom.* In mont. Nilghiri, *Schmid*! In Assam, *Griffith*!

Cellulæ latitudine circiter $\frac{1}{2000}$, longitudine $\frac{1}{400}$ unciæ metientes.

11. H. CAMERATUM (*Mitten*). Dioicum? caule procumbente, ramis curvatis laxe pinnatis, foliis patentibus rameis latissime ovatis subhastatis concavis subabrupte apiculatis apice serrulatis, nervo tenui medio evanido, ramulinis ovalibus acuminatis concavis angustis serrulatis, perichætialibus e basi elongata latiuscula subulatis integerrimis reflexis, theca in pedunculo rubro scabro oblongo-cylindrica suberecta inclinatave, operculo conico longirostrato, peristomio dentibus aurantiacis processibus æquilongis ciliis binis coadunatis brevioribus interpositis in membrana ad tertiam dentium partem exserta.

Hab. In Himalayæ reg. temp., Nepal, *Wallich*! Sikkim, *J. D. Hooker*! (No. 1076). Kumaon, *Strachey et Winterbottom*!

H. Buchanani robustius, foliis brevioribus latioribus et pedunculo scabro diversum.

12. H. DECURVANS (*Mitten*). Caule iterum iterumque prolifero inferne nudo superne curvato ramis sensim apicem versus longitudine decrescentibus pinnato, foliis (caulinis) patentibus late ovatis obtusis in

acumen angustum breve lanceolato-productis nervo viridi citra medium evanido margine ubique minute dense serrulato, cellulis parvis angustis chlorophyllo obscuris basin versus latioribus alaribus nullis conspicuis, foliis ramulinis ovatis acuminatis acumine sæpe flexo, perichætialibus e basi ovata subulatis patulis, theca in pedunculo scabro.

Hab. In Himalaya boreali-occident., *Royle*! In vallibus Sutleji flum. alt. 8000 ped., *T. Thomson* (No. 1011).

Rami bi- triunciales. *Folia* obscuriuscula. *H. camerato* statura simile, sed foliis caulinis superne latioribus eplicatis habituque rigidiore.

13. H. PROCUMBENS. Dioicum, caule procumbente pinnato ramis curvatis, foliis patentibus late ovatis sensim subulato-acuminatis margine basi planiusculo integerrimis in ramulinis serrulatis, nervo ad $\frac{3}{4}$ evanido, cellulis elongatis latitudine $\frac{1}{4000}$, longitudine $\frac{1}{350}$ unciæ metientibus, perichætialibus parvis lanceolato-subulatis tenuissime acuminatis, theca in pedunculo elongato rubro lævi cylindrica suberecta curvula, operculo brevi conico obtuso, peristomio dentibus flavidis processibus æquilongis luteis ciliis brevioribus in membrana ad tertiam dentium longitudinis exserta.

H. glareosum, *Wils. in Sched.*

Hab. In Nepal, *Wallich*! In mont. Nilghiri, *G. Thomson*! (No. 1141), *Schmid*! *et Foulkes*!

H. Buchanani robustius, foliis cellulis angustioribus sericeis nitidis.

14. H. rutabulum, *Linn.* (H. rutabulum, H. albicans, et H. rivulare, *Wils. in Sched.*)

Hab. In Himalaya boreali-occident., *Royle*! Kashmir reg. temp., *T. Thomson*; et Tibet. occ., *T. Thomson*! (No. 1019, 1045 *b*, 1061 *b*, 1096, 1156).

15. H. campestre, *B. & S.* (H. salebrosum? *Wils. in Sched.*)

Hab. In Kashmir reg. temp., *T. Thomson*! (No. 1078).

16. H. Kamounense, *Harvey.*

Hab. In Nepal, *Wallich*!

17. H. salebrosum, *Hoffm.*

Hab. In Himalayæ boreali-occident. reg. temp., *T. Thomson*! (No. 995, 1003, 1046); et in Tibet. occid., *T. T.* (No. 1043).

18. H. plumosum, *Swartz.* (H. secundum, *Mont.*—H. œdistegum, *C. Müller, Synops.* ii. p. 350.)

Hab. In Himalayæ reg. temp., Sikkim, *J. D. Hooker* (No. 999, 1129, 1177). Nepal orient., *J. D. Hooker* (No. 997, 1001). In Kumaon, *Strachey et Winterbottom*! Simla, *T. Thomson*! (No. 1157). In mont. Khasian., *Griffith*! *J. D. Hooker et T. Thomson* (No. 1022). In mont. Nilghiri, *Perrottet*! *et Gardner*! In Ceylon, *Gardner*! (No. 1020, 1021).

19. H. glaciale. (Brachythecium, *Bryol. Europ.*)

Hab. In Tibet. occid. reg. alp. et temp., montibus prov. Ladak, alt. 12,000–18,000 ped., *T. Thomson*!

*** *Eurynchium.*

Pedunculus asper.

20. H. hians, *Hedw.* (H. cordatum, *Harvey, Icon. Plant. Rar.* t. 24. f. 9.—H. Swartzii, *Wils. in Sched.*)

Hab. In Himalayæ reg. temp., Nepal, *Wallich*! Simla et Tibet. occid. *T. Thomson*! (No. 1055, 1170). In mont. Khasian. reg. temp., *J. D. Hooker*! *et T. Thomson*! (No. 1028). Etiam per Europam et Americam borealem temperatam.

Species in Europa vel prætervisa vel cum *H. Swartzii* Turn. et *H. prælongo* Dill., cujus *H. Stokesii* Turn. synonymon est, ab auctoribus commutata. Ab *H. Smartzii* foliis nitentibus latioribus et cellulis longe majoribus certe diversa. Ab *H. prælongo* forma foliorum longe aliena.

21. H. DUMOSUM (*Mitten*). Dioicum, caule repente ramis erectis dendroideis bipinnatis, ramulis inordinatis, foliis patentibus rameis hastatis ramulinis ovato-lanceolatis nervo ad $\frac{3}{4}$ evanido marginibus tenuiter serrulatis, cellulis elongatis alaribus pluribus oblongis pallidis pellucidis ventricosis, perichætialibus ovatis subulato-attenuatis integerrimis, nervo brevi, theca in pedunculo elongato fusculo scabro ovali inæquali inclinata, operculo conico breviter curvirostrato, peristomio dentibus fusco-rubris processibus perforatis æquilongis ciliis singulis binisve dimidio brevioribus.

H. Sullivantii, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 1041).

Habitu *H. myosuroidi* subsimile. *Folia* a basi ad apicem sensim angustata, haud acuminata, planiuscula. Ab *H. Sullivantii* satis diversum et ad alienam sectionem pertinens.

22. H. HUMILLIMUM (*Mitten*). Monoicum, pusillum, habitu staturaque *H. tenelli*, foliis ellipticis acuminatis serrulatis, nervo medio evanido, cellulis elongatis alaribus paucis oblongis pallidis, perichætialibus erecto-patentibus ovato-lanceolatis serrulatis, pedunculo aspero.

Hab. In mont. Nilghiri, ad Ootacamund inter muscos arboricolas, *Foulkes*!

Pallide luteo-viride inter muscos vagans. Species pusilla asperitate pedunculi et foliorum forma, ut videtur, distincta.

23. H. scabrisetum, *Schw., Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 1037).

Pedunculus lævis.

24. H. rusciforme, *Wies.*

Hab. In Himalayæ reg. temp. et alp., Nepal, *Wallich*! Sikkim, *J. D. Hooker*! (No. 1158). Kumaon, *Strachey et Winterbottom*! Simla, &c., *T. Thomson*! (No. 965, 1150, 1155); Tibet. occid. reg. temp., *T. Thomson*! (No. 966, 1047, 1153).

A forma Europæa vulgari foliis minus acuminatis paululum recedit. Specimina fere omnia sterilia.

25. H. vagans, *Harvey, Hook. Icon. Plant. Rar.* t. 24. f. 2. (H. Megapolitanum, *Wils. in Sched.*)

Hab. In Himalayæ reg. temp., Nepal, *Wallich*! Sikkim, *J. D. Hooker*! (No. 1084, 1161). Dioicum, *H. hianti* simile, sed pedunculo lævi.

26. H. SEMITORTUM (*Mitten*). Dioicum? caule procumbente ramoso, foliis patenti-divergentibus compressis sparsis, caulinis ovalibus ovatisve subulato-acuminatis semitortis nervo ad $\frac{3}{4}$ evanido marginibus minute serrulatis, rameis subbifariis ovatis asymmetricis acutis argutius serrulatis, cellulis elongatis longitudine $\frac{1}{4000}$ latitudine $\frac{1}{250}$ unciæ metientibus alaribus nullis, perichætialibus lanceolatis integerrimis e basi erecta squarroso-reflexis, theca in pedunculo lævi gracili oblonga inæquali horizontali, operculo conico rostrato peristomio interno processibus pertusis ciliis binis appendiculatis interpositis in membrana ad dentium tertiam longitudinis partem exserta.

H. Megapolitanum, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 968).

H. Swartzii statura habituque subsimile, sed foliis magis ovalibus, nervo uno lateri propinquiore, et pedunculo lævi.

27. H. PLANIUSCULUM (*Mitten*). Monoicum, caule procumbenti, foliis patentibus ovatis paululum asymmetricis planiusculis nervo ad $\frac{3}{4}$ evanido marginibus serrulatis, cellulis elongatis angustis longitudine $\frac{1}{3000}$ latitudine $\frac{1}{330}$ unciæ metientibus ad basin majoribus alaribus vix ullis distinctis, perichætialibus e basi ovata subulatis patentibus enerviis serrulatis, theca in pedunculo lævi rubro gracili oblonga indurata, operculo conico rostrato, peristomio normali.

H. Megapolitanum, *Wils. in Sched.*

In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 969).

H. conferto subsimile, foliis tamen planioribus et apicem versus angustioribus.

28. H. HERBACEUM (*Mitten*). Monoicum, caule procumbente, ramis vage ramosis ramulis elongatis subsimplicibus, foliis subcompressis patentibus ovatis acuminatis planiusculis nervo ad $\frac{3}{4}$ evanido marginibus serrulatis, cellulis elongatis longitudine $\frac{1}{2000}$ latitudine $\frac{1}{500}$ unciæ metientibus alaribus nullis, perichætialibus lanceolatis attenuatis

patulis, theca in pedunculo elongato oblongo-cylindrica horizontali, operculo conico rostrato, peristomio normali.

H. Megapolitanum, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 1162). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! (No. 1099).

Formis majoribus *H. Megapolitani* simile, sed foliis basi angustioribus.

29. H. SPARSILE (*Mitten*). Monoicum, pusillum, prostratum, caule vage ramoso, foliis remotis distichaceis patentibus lanceolatis planis a medio ad apicem subserrulatis integerrimisve nervo ad medium evanido, cellulis valde elongatis laxiusculis, perichætialibus lanceolatis patentibus, theca in pedunculo elongato cylindrica collo sensim attenuato inclinata suberectave.

Hab. In Assam superiore, *Griffith*!

Parvulum, habitu adspectuque formarum minorum graciliorum *H. riparii*. *Folia* haud acuminata, sed a medio ad apicem sensim angustata directione statu sicco haud mutata. *Theca* æqualis. *Peristomium* (fide Griffithii) *Leskeæ*.

30. H. Tavoyense, *Hook.* (Hookeria prostrata, *Harvey*, *Hook. Icon. Plant. Rar.* t. 20. f. 5.)

Hab. Ad Tavoy, *Wallich*! In planitie Indiæ tropicæ, Behar, *J. D. Hooker*! (No. 1073).

31. H. WIGHTII (*Mitten*). Monoicum, prostratum, subpinnatum, ramis vagis elongatis deplanatis, foliis patenti-divergentibus elliptico-lanceolatis obtusis sublingulatis apice apiculo parvo, nervo paulo ultra medium evanido, margine apice serrulato, cellulis elongatis angustis, perichætialibus patulis ovatis acumine lanceolato superne serrulato, theca in pedunculo gracili elongato erecta inclinata horizontalique, operculo conico acuminato, peristomio interno processibus dentibus æquilongis ciliis brevissimis interpositis in membrana ad tertiam partem dentium longitudinis exserta.

Hab. Ad Madras, *Wight*! In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! Ad Moulmein, *Parish*!

H. *Tavoyensi* simile, speciosius tamen, foliis non a medio ad apicem acuminatis sed sublingulatis cellulis dimidio angustioribus.

32. H. ligulatum, *C. Müller, Bot. Zeit.* 1856, p. 438.

Hab. In India orient. *Elphinston.*

**** *Amblystegium.*

33. H. serpens, *Linn.*

Hab. In Tibet. occid. reg. temp., *T. Thomson*! (No. 1077).

34. H. OBTUSULUM (*Mitten*). Dioicum? habitu *H. serpentis*, foliis patentibus laxis ovatis sensim angustatis, nervo crasso sub apice sub-

obtuso evanido, marginibus superne minute serrulatis, cellulis minutis brevibus oblongis obscuriusculis, perichætialibus ovato-lanceolatis acutis apice serrulatis, theca in pedunculo elongato ovali cylindrica inclinata, peristomio processibus solidis dentium longitudine ciliis singulis interpositis in membrana ad tertiam dentium partem exserta.

Hab. In Himalayæ occidentalis regione temperata, Kumaon, ad Saba, alt. 9000 ped., *Strachey et Winterbottom* !

H. fluviatili H. irriguoque affine, sed minus, foliis non acuminatis apice latiusculo subobtuso et cellulis longe minoribus.

35. H. tenuissimum. (Amblystegium, *Bryol. Europ.*)

Hab. In Tibet. occid. reg. temp., *T. Thomson* (No. 1036).

36. H. RIVICOLA (*Mitten*). Monoicum, *H. radicali* simillimum, foliis ovato-lanceolatis haud acuminatis, cellulis distinctis iis *H. radicalis* paululum longioribus, perichætialibus apice brevi-acuminatis serrulatis.

Hab. In Tibet. occid. reg. temp., vallibus fluvii Indi, *T. Thomson* (No. 991, ex parte, *H. campestri* consociatum).

H. radicali vero, non Bryologiæ Europææ (ubi species sub hoc nomine bene illustrata ad *H. varium* certe pertinet), valde affine, sed e speciminibus imperfectis forma foliorum magis ovata non sensim acuminata et statura majore spicarum diversum videtur.

37. H. riparium, *Linn.*

Hab. In Tibet. occid. reg. temp., *T. Thomson* ! (No. 1083 *b*).

38. H. TIBETANUM (*Mitten*). Caule pinnato subsimplicive, foliis laxis patentibus ovato-lanceolatis planiusculis integerrimis nervis binis sub medio evanidis, cellulis elongatis alaribus ad angulos tantum obviis pallidis chlorophyllosis.

Hab. In Tibet. occid. reg. alp., *H. Strachey* ! (No. 1052).

Ab *H. ripario,* quocum facie, forma, cellularumque structura convenit, cellulis alaribus ad angulos aggregatis nervis binis tenuibus et habitu paululum strictiore differt.

39. H. uncinatum, *Hedw.*

Hab. In Himalayæ orient. reg. temp. et alp., Sikkim, *J. D. Hooker* (No. 980, 988, 1108).

40. H. commutatum, *Hedw.*

Hab. In Himalayæ occident., Tibet. occid. reg. temp. et alp., *T. Thomson* ! (No. 982, 983, 1138, 1159). Kashmir, *T. Thomson* (No. 990). In Kumaon, *Strachey et Winterbottom* !

41. H. filicinum, *Linn.*

Hab. Forma vulgaris in Tibet. occid. reg. temp. et alp., *T. Thomson* (No. 994, 1067, 1082, 1136, 1143, 1145, 1147, 1153, 1154). Himalayæ occident. reg. temp., Jamu, *T. Thomson* ! (No. 1098, 1175). Kumaon, *T. Thomson* (No. 1142).

Forma major in Tibet. occid. reg. alp., *T. Thomson* (No. 992, 1080). Jamu, temp. (No. 998), forma foliis strictis.

Forma "vallis-clausæ" in Tibet. occid. reg. temp., *T. Thomson* (No. 985, 986, 1079). In Himalaya boreali-occident., *Royle* !

42. H. ORBICULATUM (*Mitten*). Monoicum, *H. Zippellii* simillimum, foliis patentibus subsecundis e basi orbiculari acuminatis, nervo crasso percurrente, marginibus integerrimis, cellulis parvis oblongis obscuris alaribus inconspicuis, perichætialibus erectis lanceolatis plicatis, theca in pedunculo elongato flexuoso ovali-cylindrica inæquali inclinata, peristomio interno processibus dentium longitudinis ciliis binis brevioribus interpositis in membrana fere ad dentium dimidium exserta.

Hab. In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! (No. 1122).

Habitu, colore et statura *H. Zippellii*, Dozy et Molk., foliis tamen non cordato-ovatis sed orbiculari-acuminatis.

43. H. SAXETORUM (*Mitten*). Monoicum, caule repente, ramis fasciculatis, foliis patentibus ellipticis concavis convolutis integerrimis apice obtusiusculis subcucullatis, nervo tenui percurrente, cellulis elongatis angustis alaribus distinctis paululum ventricosis fuscis, perichætialibus lanceolatis apice latiusculis breviter apiculatis ut plurimum in lacinias 2-3 fissis, theca in pedunculo pallide fusco oblonga inclinata, operculo conico.

Hab. ——?

Color in apicibus caulium flavo-rufescens, mox fuscescens, subniger. Statura *H. conferti*.

3. METEORIUM, *Brid. emend.*

Pilotrichum ex parte (*C. Müller, Synops.* ii. p. 152), Esenbeckia (*Brid.* ii. p. 753), Cryptotheca (*Hornschuch, in Muscis Mexicanis a Deppe et Schiede lectis*), Acrobryum (*Dozy et Molk. in Kruidk. Arch.*).

Folia uninervia, cellulis elongatis. *Calyptra* mitriformis.

Genus a *Pilotrichis* veris foliis binervatis cellulisque rotundatis satis alienum. A *Trachypode*, quocum similitudinem magnam in speciebus nonnullis habet, cellulis angustis et calyptræ forma recedit.

* *Esenbeckia.*

Rami procumbentes erective.

1. M. plicatum. (Esenbeckia, *Nees.*)

Hab. In Himalayæ orient. reg. temp., in montibus Yalloong, alt. 10,000 ped., fragmentum, *J. D. Hooker.*

2. M. crassicaule. (Neckera, *C. Müller, Synops.* ii. p. 132.)

Hab. In Ceylon, *Gardner* (No. 798).

Caulis elongatus, semipedalis, procumbens? dependensve? simplex vel

interdum ramulis pluribus diversæ crassitudinis ramosus. *Folia* perichætialia elongata. *Theca* immersa, ovali-cylindrica. *Peristomium* parvum.

3. M. FLEXIPES (*Mitten*). *M. crassicauli* simillimum, ramis non flagelliferis parce ramosis ut plurimum simplicibus, foliis patulis turgide concavis late ovatis obtusis apiculo brevi-subulato marginibus subintegerrimis vix distincte serrulatis nervo brevi tenui infra medium evanido, cellulis angustis elongatis alaribus pluribus parvis quadratis fuscis, perichætialibus elongatis in cylindrum convolutis, theca in pedunculo perichætii longitudine interdum paululum longiore flexo ovali-cylindrica.

Hab. In mont. Nilgiri, *Gough*! *Gardner*! In Ceylon, *Thwaites*! *et Walker*!

M. crassicauli valde simile, sed paululum gracilius, foliis acumine breviore et theca e perichætio anguste convoluto exserta.

4. M. WIGHTII (*Mitten*). Caule repente, ramis simplicibus parce ramosisve, foliis divergentibus latissime ovatis concavis acutis basi cordatis alis parvis undulatis circinatis nervo ad $\frac{3}{4}$ evanido margine superne serrulatis, cellulis angustis alaribus nullis distinctis basi infima paucis parum latioribus fuscis, perichætialibus e basi lata amplexante subito attenuatis serrulatis, theca immersa in pedunculo brevissimo ovali, operculo conico acuminato, peristomio dentibus pallidis processibus sessilibus æquilongis, calyptra parva mitriformi pilosa.

Hab. In Nepal, *Wallich*! In Rangoon, *Herb. Wight*!

M. Brasiliensi (*Antitrichia,* Hornsch.) statura simile, sed foliis basi auriculis circinatis; *M. pingui* affinius. Ab affinibus foliis densis divergentibus et theca immersa refugit.

5. M. FOULKESIANUM (*Mitten*). (*M. acuminato* simillimum.) Foliis late ovalibus concavis acutis vix acuminatis nervo ad $\frac{3}{4}$ evanido margine integerrimo, cellulis angustis alaribus a margine remotiusculis fuscis subquadratis subobscuris inter eas et marginem parvis quadratis obscuriusculis.

Hab. In mont. Nilghiri, *Foulkes*!

Rami bi- triunciales, rarius inordinate parce ramulosi, subfasciculati, curvati, habitu *Leucodonti secundo* similes. *Folia* imbricata, nitida, concava, apicem versus non excavata, basi rotundata. Structura descripta ab affinibus dignoscitur.

6. M. orientale. (Neckera, *C. Müller*, *Bot. Zeit.* 1856, p. 437.)

Hab. In India orientali, *Herb. Sendtner.*

7. M. SCABRIUSCULUM (*Mitten*). Dioicum, caule repente, ramis subpinnatis simplicibusve, foliis julaceo-imbricatis patentibus oblongis cymbiformibus apiculo brevi latiusculo marginibus integerrimis nervo ad medium evanido, cellulis angustis alaribus pallide fuscis pellucidis,

perichætialibus vaginantibus, theca in pedunculo semunciali gracili scabriusculo ovali.

Hab. In montibus Concan, *Law*!

Facie *M. acuminati*, foliorum forma autem *M. frondoso* affine; theca longius exserta in pedunculo scabriusculo diversum.

8. M. FRONDOSUM (*Mitten*). Dioicum, caule repente, ramis elongatis subdendroideis pinnatis, ramulis patentibus, foliis julaceo imbricatis oblongis cymbiformibus apiculo brevi latiusculo basi rotundatis marginibus integerrimis, nervo ad medium evanido, cellulis angustis lævibus alaribus fuscis incrassatis obscuris, perichætialibus elongatis vaginantibus, theca in pedunculo subsemunciali (cujus dimidium e perichætio exsertum) ovata subinæquali.

Neckera acuminata, *Wils. in Sched.*

Hab. In Ceylon, *Gardner* (No. 826, 827) *et Walker.*

M. acuminato habitu facieque simile, sed paululum robustius, foliis longioribus, apiculo latiore, et basin versus non dilatatis.

9. M. acuminatum. (Neckera, *Hook. Musc. Exot.* t. 151.)

Hab. In Himalaya centrali et orientali, Nepal et Sikkim, *Gardner*! *J. D. Hooker*! In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 828).

In icone Hookeriana folia basin versus non satis ampliata depicta sunt. *Rami* erecti, inferne nudi, superne ramulis decrescentibus frondiformi-pinnati. *Folia* straminea nitentia, e basi subcordata latissime ovata, cymbiformi-concava, medio tenus nervata, apiculo plano, margine serrulato, cellulis angustis distinctis alaribus numerosis latioribus quadratis oblongisque subobscuris fuscis.

Rami elongati penduli.

10. M. HOOKERI (*Mitten*). Caule primario repente, ramis erectis frondiformi- regulariter pinnatis pendulisve longissimis parce divisis, ramulis brevibus pinnatis, foliis patulis divergentibusque late ovatis acuminatis planiusculis basi cordatis, alis parvis circinatis, nervo brevi furcato, marginibus serrulatis, cellulis elongatis distinctis lævibus, perichætialibus basi latis elongatis convolutis longe subulatis, theca in pedunculo brevissimo immersa globoso-ovali.

Pilotrichum crassum, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 809, 810, 811). In mont. Khasian. teg. temp., *J. D. Hooker et T. Thomson* (No. 797).

Caulis pendulus, pedalis vel sesquipedalis. *Folia* straminea viridiave. *M. specioso* subsimile, sed foliis magis divaricatis; a *M. tumido* foliorum forma superne latioribus apice acutis, cellulis ubique angustis differt.

11. M. tumidum. (Neckera, *Dicks.*)

Hab. Ad Madras, G. *Thomson*! In Ceylon, *Gardner*! (No. 940).

Folia patula, cordato-ovata, acuminata, apice acuta obtusiusculave, nervo variabili sub apice evanido, margine superne minute eroso, cellulis

superne ovoideis inter se subremotis inferioribus elongatis angustis alaribus nullis, perichætialibus patentibus lanceolatis. *Theca* immersa ovalis, operculo conico rostrato. *Calyptra* parva, operculo brevior.

12. M. NITIDUM (*Mitten*). Caule repente, ramis frondiformibus regulariter pinnatis pendulisve elongatis flexuosis inordinate laxe pinnatis, foliis patentibus laxe imbricatis oblongo-ovalibus breviter apiculatis tri- quadri- profunde plicatis basi cordatis, alis rotundatis crenatis undulatis margine serrulatis, nervo brevissimo vix distincto, cellulis elongatis angustis distinctis lævibus, perichætialibus elongatis ellipticis longe acuminatis convolutis erectis subintegerrimis, theca in pedunculo brevissimo immersa globoso-ovali.

Pilotrichum nitidum, *Wils. in Sched.*

Hab. In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 800, 915). In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 865 *b*).

Rami erecti, biunciales, penduli, pedales; ramuli cum foliis latitudine circiter lineares. *Folia* pallide viridia subnitida.

13. M. speciosum. (Acrobryum speciosum, *Dozy et Molk.* cum icone in *Kruidk. Arch.*)

Hab. In mont. Khasian. reg. temp., ad Maamloo, *Griffith*! Nunklow, *J. D. Hooker et T. Thomson*! (No. 799) (etiam in Java).

14. M. DIVERGENS (*Mitten*). Ramis strictis, foliis divergentibus late ovatis subcordatis in acumen tortum attenuatis marginibus serrulatis nervo brevi simplici furcatove, cellulis elongatis angustis lævibus basi paucis rubris.

Pilotrichum squarrosum, *Wils. in Sched.*

Hab. In collibus Jyntea (prope Silhet), reg. subtrop., *J. D. Hooker et T. Thomson* (No. 803).

A *M. squarroso* foliis divergentibus haud squarroso-reflexis et ramis strictis differt. A *M. specioso* foliis magis congestis strictius divergentibus et structura certe recedit.

15. M. squarrosum. (Neckera, *Hook. Icon. Plant. Rar.* t. 22.)

Hab. In Himalayæ reg. temp., Nepal, *Wallich*! Sikkim, *J. D. Hooker*! (No. 805, 913, 923). Kumaon, *Strachey et Winterbottom*! In Behar, monte Paras Nath, *J. D. Hooker*! (No. 816). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 801, 914, 916, 921, 922, 931, 934). In mont. Nilghiri, *M'Ivor*! Ad Madras, *Wight*! In Ceylon, *Gardner*! (No. 814, 929). In Moulmein, *Parish*! Ad Rangoon, *M'Clelland*!

16. M. reclinatum. (Pilotrichum reclinatum, *C. Müller, Bot. Zeit.* 1854, p. 572.)

Hab. In mont. Nilghiri, *Schmid.*

17. M. PHÆUM (*Mitten*). Dioicum? caule repente, ramis longissimis pendulis inordinate pinnatis, foliis laxe patulis basi subcordatis ovatis

tenuiter acuminatis nervo medio tenui marginibus minute serrulatis, cellulis elongatis longitudine $\frac{1}{800}$ latitudine $\frac{1}{4000}$ unciæ metientibus circiter tripapillosis obscuris, perichætialibus ovato-lanceolatis longioribus tenuioribus, theca in pedunculo brevissimo ovali immersa, peristomio dentibus elongatis interno processibus longioribus sessilibus.

Pilotrichum phæum, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 837, 841, 852, 878).

Rami spithamei, flexuosi, foliis pulchre flavidis subrubentibus, vetustioribus fusco-nigricantibus.

18. M. FLAMMEUM (*Mitten*). Dioicum? caule repente, ramis longis laxe pinnatim ramosis flexuosis pendulis, foliis squarrosis late ovatis subcordatis subulato-acuminatis, rameis ovatis longe subulato-attenuatis, nervo sub acumine evanido, marginibus minute serrulatis undulatis, cellulis elongatis punctulatis basin versus pellucidioribus lævibus alaribus nullis, perichætialibus lanceolatis erectis, theca in pedunculo æquilongo e perichætio exserta ovali, operculo subulate conico-rostrato.

Pilotrichum phæum, ex parte, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 804).

M. phæo perquam simillimum, foliis autem caulinis latioribus nitidioribus, cellulis latioribus; *perichætium* parvum, foliis angustis et theca exserta diversum.

19. M. SOLUTUM (*Mitten*). Ramis pinnatim ramosis, foliis e basi cordata erecta auriculis parvis circinatis caulem amplectente ovatis recurvo-squarrosis subulato-attenuatis concavis margine ubique minutissime serrulatis, nervis binis inæqualibus brevissimis indistinctisve, cellulis angustis elongatis lævibus alaribus nullis.

Hypnum stellatum, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 970).

Habitu facieque speciminum paucorum *Hypno stellato* subsimile, foliis autem magis squarrosis; a reliquis *Meteoriis* Indicis nervis binis brevibus recedit.

20. M. cordatum. (Hypnum, *Harvey, Hook. Icon. Plant. Rar.* t. 24. f. 9.)

Hab. In Nepal, *Wallich*! In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! (No. 724).

Habitu rigidiore a *M. patulo* et affinibus paululum recedit. Calyptram non vidi.

21. M. MEMBRANACEUM (*Mitten*). Ramis elongatis pendulis flexuosis pinnatim ramosis, foliis imbricatis pallidis basi cordatis alis parum undulatis ovatis sensim lanceolato-acuminatis undulatis concavis nervo sub apice evanido margine serrulatis, cellulis parvis angustis indistinctis papillosis basi conformibus.

Hab. "In montibus Negrogam versus regionis Assamicæ altæ," *Griffith*!

Caulis pedalis, habitu, mollitie, statura coloreque *Neckeræ molli* simile,

foliis tamen tenui-membranaceis valde papillosis. E substantia quamvis nullibi obscura opacave cellulas observare non facile est.

22. M. Wallichii. (Neckera, *Decand.*)

Hab. In Nepal, *Wallich.* Per Indiam temperatam et calidiorem, inter muscos vulgare; in Ceylon, *Gardner.*

23. M. Hookeri (*Mitten*). Dioicum, caule repente, ramis elongatis pendulis flexuosis inordinate pinnatim ramosis, foliis patentibus e basi cordatis alis undulatis amplectentibus sensim angustatis apice lanceolato-piliformi-attenuatis semitortis, nervo medio evanido, margine ubique serrulato undulato, cellulis basi in folii medio majoribus pellucidioribus quasi a basi nervi radiatim dispositis superioribus elongatis papillosis subobscuris, perichætialibus patentibus ovato-lanceolatis undulatis, theca in pedunculo æquilongo exserta inclinata ovali, operculo conico brevirostrato, peristomio dentibus angustis processibus æquilongis in membrana ad dentium ¼ longitudinis exserta.

Pilotrichum canescens ex parte, et P. fuscescens ex parte, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., *J. D. Hooker* (No. 839). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 888).

M. aureo simile habitu coloreque, sed foliis brevioribus piliformi-attenuatis acumine flavo nunquam canescente et cellulis quasi a basi ad medium radiatis.

24. M. commutatum (*Mitten*). Caule repente, ramis elongatis flexuosis pinnatis pendulis, foliis erecto-patentibus e basi cordata sensim late lanceolato-attenuatis marginibus dense minute serrulatis nervo medio evanido, cellulis angustis dense minute papillosis obscuris basi pallidioribus alaribus paucis vix conspicuis.

Pilotrichum canescens, ex parte, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 876, 851, ex parte).

M. canescenti persimile, foliis autem magis attenuatis, cellulis angustioribus obscurioribus et ad folii basin aliter dispositis.

25. M. hispidum. (Neckera hispida, *C. Müller, Bot. Zeit.* 1854, p. 570.)

Hab. In mont. Nilghiri, *Schmid.*

26. M. aureum (*Mitten*). Caule repente ramis longissimis pendulis flexuosis inordinate pinnatim ramoso, foliis patentibus basi subcordatis sensim angustatis hastato-lanceolatis margine sæpe subpellucido serrulatis nervo medio evanido, cellulis basi ad nervum pellucidioribus in formam semiorbicularem dispositis superioribus obscuris, perichætialibus patentibus ovato-lanceolatis tenuiter acuminatis, theca (ex icone Griffithii) emergente ovali, operculo conico subulato, calyptra mitriformi glabra.

Neckera aurea, *Griff. Not.* p. 459; *Icon. Plant. Asiat.* ii. t. 87. f. 11.—Pilotrichum canescens, ex parte, et P. aurantiacum, *Wils. in Sched.*

Hab. In mont. Khasian. reg. temp., ad Maamloo, *Griffith*! *J. D. Hooker*

et T. Thomson (No. 868, 892, 894, 927). In collibus Jyntea, *J. D. Hooker et T. Thomson* (No. 880). In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 841 *b*, 851).

Caulis gracilis, longissimus, sæpe pedalis, ramis varie flexis subuncialibus. *Color* in partibus junioribus flavus, ætate sensim fuscescens, nitoris destitutus. *M. floribundo* affine, sed robustius.

27. M. RETRORSUM. Ramis elongatis pendulis flexuosis vage subpinnatis, foliis patenti-appressis e basi subcordata vix undulata ovato-lanceolatis attenuatis margine serratis serraturis sæpe retroflexis superne paululum undulatis nervo ad medium evanido, cellulis omnibus conformibus papillosis subobscuris.

Hab. In Ceylon insula, *Gardner*!

M. aureo simile, paululum crassius, foliis appressioribus, cellulis majoribus subdistinctis basi non mutatis.

28. M. CONVOLVENS (*Mitten*). Caule repente, ramis longis flexuosis pendulis inordinate pinnatis, foliis rameis appressis ramulinis patentibus laxis ovato-lanceolatis tenuiter acuminatis marginibus minute remotiuscule serrulatis, nervo medio evanido, cellulis elongatis lævibus conformibus, perichætialibus ovato-lanceolatis parvis vagina vix duplo longioribus, theca in pedunculo curvato scabro æquilongo ovali scabra, operculo conico rostrato, peristomio interno processibus angustis e membrana brevi orientibus, calyptra parva lævi.

Hab. Ad mont. Malabar, G. *Thomson*! (No. 831 *b*). *M. floccoso* gracilius, ramis foliis appressis; a *M. auronitente M. filamentosoque* habitu longe graciliore proceriore et fructu diversum.

29. M. SPICULATUM (*Mitten*). Caule repente, ramis vage subpinnatim ramosis pendulis, foliis patulis ovato-lanceolatis tenuiter acuminatis marginibus serrulatis nervo ultra $\frac{3}{4}$ evanido, cellulis elongatis sublævibus alaribus binis ternisve parvis vix conspicuis.

Pilotrichum Griffithianum, ex parte, *Wils. in Sched.*

Hab. In mont. Khasian. reg. trop., *J. D. Hooker et T. Thomson*! (No. 964).

M. lanoso paululum gracilius, foliis strictis spiculosis patulis. *Color* in ramulorum apicibus luteo-viridis, flavescens, mox fusco-nigricans.

30. M. LANOSUM (*Mitten*). Caule repente, ramis longis flexuosis pendulis laxe subpinnatim ramosis, foliis divergentibus ovato-lanceolatis attenuatis marginibus serrulatis superne plus minus undulatis nervo ultra $\frac{3}{4}$ evanido, cellulis omnibus conformibus elongatis unipapillosis.

Pilotrichum Griffithianum, P. corrugatum, et Hypnum auronitens, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 884). In Ceylon, *Gardner* (No. 813, 936). Etiam in Hong-Kong, *Bowring*! (et insulis Maris pacifici).

A *M. auronitente M. filamentosoque* foliis mollioribus laxioribus divergentibus diversum.

31. M. auronitens. (Hypnum, *Hook.*, *Schw.* t. 221.—Pilotrichum filamentosum, *Wils. in Sched.*)

Hab. In Himalayæ reg. temp., Nepal, *Wallich*! *J. D. Hooker* (No. 817); Sikkim, *J. D. Hooker* (No. 933). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! In mont. Nilghiri, *M'Ivor*! *Schmid*! *G. Thomson* (No. 831).

32. M. filamentosum. (Neckera, *Hook. Musc. Exot.* t. 158.—Hypnum auronitens, *Wils. in Sched.*)

Hab. In Himalayæ reg. temp., Nepal, *Wallich*! Sikkim, *J. D. Hooker*! (No. 832, 883, 887, 932). In mont. Nilghiri, *Foulkes*!

A *M. auronitente*, quamvis persimillimum, cellulis majoribus certe recedit.

33. M. punctulatum, *C. Müller, Bot. Zeit.* 1854, p. 571.

Hab. In mont. Nilghiri, *Schmid.*

34. M. Schmidii, *C. Müller, Bot. Zeit.* 1854, p. 571.

Hab. In mont. Nilghiri, *Schmid.*

35. M. INFUSCATUM (*Mitten*). Caule repente, ramis flexuosis vage subpinnatis pendulis, foliis e basi oblongo-ovatis sensim late acuminatis marginibus dense serrulatis nervo medio evanido, cellulis elongatis alaribus paucis crassiusculis fusco limbatis pellucidis, perichætialibus internis elongatis apicibus latis lanceolatis denticulatis, theca (juvenili tantum visa) immersa, calyptra parce pilosa.

Pilotrichum phæum, ex parte, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 906).

M. phæo M. flammeoque simillimum, foliis tamen magis oblongis, perichætialibus internis apicibus latis alienum. *Color* viridis, mox fuscescens, nitoris expers.

4. TRACHYLOMA, *Brid.*

1. T. INDICUM (*Mitten*). Caule seu rhizomate repente, ramis superne pinnatis frondiformibus, foliis patulis compressis ovatis apice acutis semitortis lateralibus asymmetricis, nervo sub medio evanido, margine minute serrulato, cellulis omnibus conformibus angustis.

Hab. In Ceylon, *Thwaites*! Etiam in Java.

T. planifolio gracilius, foliis laxius dispositis, cellulis laxioribus duplo latioribus obscurioribus distinctissimum. Adsunt in ramulorum apicibus, in foliorum axillis corpuscula articulata rufa.

2. T. ARBORESCENS (*Mitten*). Dioicum, caule repente, ramis erectis dendroideis inferne foliis sparsis divaricatis laxe vestitis superne in frondem horizontaliter explanatis subbipinnatim ramosis ramulis congestis attenuatis, foliis patulis late ovatis acutis, nervo tenuiusculo dorso apice dentato sub summo apice evanido, marginibus duplicato-serratis, cellulis elongatis angustis lævibus alaribus nullis.

Hab. In Ceylon, *Gardner* (No. 1016).

T. Reinwardtii simillimum et forsan ejus forma, sed foliis pro longi-

tudine latioribus minus acuminatis, cellulis paululum latioribus, etiam habitu frondium magis horizontaliter explanatis ab eo diversum esse videtur.

3. T. Taylori. Ramis elongatis pendulis pinnatis rigidis, foliis imbricatis e basi cordata alis rotundatis minutissime crenulatis brevi subquadrato-ovatis acuminatis apice iterum in mucronem brevem acuminatis integerrimis concavis vix carinatis, nervo sub apice evanido concolori, cellulis superne minutis subobscuris margine sæpe pallidioribus inferne elongatis pallidis.

Neckera cuspidifera, *Taylor, MSS., in Hb. Greville.*

Hab. ——?

Species *Trachypodibus* nonnullis Australibus affinis, sed ambitu foliorum, habitu rigidiore, coloreque in senectute magis ferrugineo certe aliena.

5. Stereodon, *Brid.*, ex parte.

Hypnum, Pterogonium, Leskea, Leptohymenium et Neckera, *auct.*, ex parte; Plagiothecium, Orthothecium, Pylacesia, Cylindrothecium, et (ex parte) Leskea et Hypnum, *Schimper.*

Folia binervia vel enervia.

i. *Cupressina.* Rami pinnati.

A. *Theca* brevirostrata.

* *Peristomium* imperfectum.

1. S. juliformis. (Pterogonium julaceum, *Hook.*—P. squarrosum, *Griff. Not.* p. 448; *Icon. Plant. Asiat.* ii. t. 98. f. 11.)

Hab. In Himalayæ reg. trop., Nepal, *Wallich*! Sikkim, *J. D. Hooker* (No. 769). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! (No. 753 *b*). In Assam superiore, *Griffith*! In Moulmein, *Parish*! In mont. Nilghiri, *Schmid.*

2. S. inflexus. (Hypnum inflexum, *Harvey, Hook. Icon. Plant. Rar.* t. 24.)

Hab. In Nepal et Ava, *Wallich*!

Species dioica, *S. julaceo* similis, sed minor, foliis latissime ovatis acuminatis tereti-imbricatis, marginibus suberosis dorso papillosis, nervis binis brevissimis, cellulis inferioribus parvis quadratis fere ad dimidium folii protractis superioribus elongatis angustis, perichætialibus erectis apicibus lanceolatis serrulatis, theca in pedunculo elongato gracili inclinata horizontalive, operculo conico.

Folia, in icone Harveyana, uninervia et inferne minus quam in natura lata falso delineata sunt. Peristomium non vidi, sed habitu *S. juliformi* valde similis.

3. S. decolor (*Mitten*). Dioicus? cæspitosus, ramis elongatis, foliis orbiculari-ovatis acuminatis patentibus, nervis binis infra medium evanidis, margine integerrimo, cellulis superioribus ad apiculi basin subellipticis inferioribus oblongis subquadratisque alaribus pluribus

transverse oblongatis parallelogrammaticis concoloribus, perichætialibus erectis elongatis convolutis acuminatis integerrimis, theca in pedunculo gracili elongato ovali erecta, peristomio dentibus angustis elongatis interno processibus brevibus $\frac{2}{3}$ dentium longitudinis in membrana ad $\frac{1}{5}$ dentium longitudinis exserta.

Pylacesia brevifolia, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp. et alp., Sikkim, *J. D. Hooker* (No. 759, 761).

Facie *Pterogonii filiformis*, habitu staturaque etiam conveniens, foliis autem latissime ovatis et cellulis brevibus copiosis.

4. S. pinetorum. (Pleuropus pterogonioides, *Griff. Not.* p. 470; *Icon. Plant. Asiat.* ii. t. 89. f. 4; *Calc. Journ. Nat. Hist.* vol. iii. p. 272, t. 20.)

Hab. In mont. Khasian. reg. temp., in pinetis Moflong, *Griffith*! *J. D. Hooker et T. Thomson*! fragmentum.

Caulis repens, ramis brevibus confertis, foliis densis patentibus ovali-ellipticis, concavis, in apiculum angustum productis, margine integerrimis inferne planiusculis, cellulis angustis alaribus pluribus.

5. S. flavescens. (Pterogonium, *Hook. Musc. Exot.* t. 155; *Griff. Icon. Plant. Asiat.* ii. t. 98. f. 4.—Fabronia striata, *C. Müller, Synops.* ii. p. 39.—Campylodontium striatum, *Dozy et Molk. Musc. Archip. Ind.* t. 39.)

Hab. In Himalayæ reg. temp., Nepal, *Gardner*! *Wallich*! *J. D. Hooker* (No. 760); Sikkim, *J. D. Hooker* (No. 984). In mont. Khasian., *J. D. Hooker et T. Thomson*! (No. 781). In Assam, *Griffith*!

6. S. CONDENSATUS (*Mitten*). Monoicus, caule repente ramis curvatis densis ramoso, foliis imbricatis oblongo-ovatis concavis in apiculum integerrimum subserrulatumve acuminatis basi latiusculis, nervis binis brevissimis, cellulis angustis elongatis alaribus copiosis parvis concoloribus quadratis transverseque oblongis, rameis ovatis sensim angustatis cellulis alaribus obscuris, perichætialibus erectis internis elongatis convolutis superne serrulatis, theca in pedunculo elongato rubro ovali erecta, operculo conico acuminato, peristomio interno processibus angustis ad dentium $\frac{2}{3}$ protractis in membrana ad $\frac{1}{3}$ dentium longitudinis exserta, annulo simplici.

Hab. In Himalayæ occid. reg. temp., Kumaon, ad Jàgesai, *Strachey et Winterbottom*!

S. intricato (*Pterogonium*, Schw.) simillimus, foliis autem teretiuscule imbricatis, ramis curvatis rigidulis et peristomio diversus. Species in structura foliorum transitionem a speciebus *S. julaceo* similibus in illas *S. polyantho* affiniores ostendens.

7. S. chryseus. (Orthothecium chryseum, *Bryol. Europ.* fasc. xlviii. t. 2. —Leskea aurea, vel affinis, *Wils. in Sched.*)

Hab. In Tibet. occid. reg. alp., alt. 16,000–17,000 ped., *T. Thomson*! (No. 1030).

8. S. aureus. (Pterogonium, *Hooker, Musc. Exot.* t. 147.—Pleuropus densus, *Griffith, Not.* p. 467; *Icon. Plant. Asiat.* ii. t. 89. f. 1, et t. 90. f. 2; *Calcutta Journ. Nat. Hist.* vol. iii. t. 17.)

Hab. In Himalayæ reg. temp., Nepal, *Wallich*! *Gardner*! Sikkim, *J. D. Hooker* (No. 762). In mont. Khasian., ad Moflong, *Griffith*!

9. S. capillaceus. (Neckera, *Griffith, Not.* p. 457; *Icon. Plant. Asiat.* ii. t. 89. f. 3.)

Hab. In mont. Khasian. reg. temp. ad Surureem, rarus, *Griffith*.

10. S. brevirostris. (Neckera, *Griffith, Not.* p. 455; *Icon. Plant. Asiat.* ii. t. 85. f. 1, 1′, 1″.

Hab. In mont. Khasian., ad Surureem, in arbore, *Griffith*.

11. S. RUSSULUS (*Mitten*). Dioicus? caule repente, ramis confertis cæspitosis, foliis patentibus ovato-lanceolatis concavis, marginibus revolutis apice subserrulatis, nervis binis brevissimis obsoletisve, cellulis elongatis angustis alaribus incrassatis fuscis, perichætialibus interioribus late lanceolatis integerrimis, theca in pedunculo gracili rufo ovali erecta, operculo curvirostrato, peristomio externo fragili interno rufo incrassato e membrana brevi in processus fragilissimos divisa.

Leskea aurea, *Wils. in Sched.*

Hab. In Himalayæ orient., ad Sikkim, et Nepal orient. reg. temp., *J. D. Hooker*! (No. 763, 767).

S. intricato S. aureoque similis, sed foliis marginibus revolutis operculo subito in rostellum contracto et peristomio diversus. *Flores* masculos non inveni. *Color* russulus, nitidus.

12. S. TENUIRAMEUS. Dioicus? caule repente, ramis pinnatis confertis, foliis laxis patentibus ovatis concavis acuminatis, rameis anguste ovali-acuminatis integerrimis apiceve subserrulatis, nervis binis brevibus, cellulis elongatis angustis alaribus latis quadratis concoloribus pellucidis, perichætialibus e basi ovata lanceolatis patentibus serrulatis, theca in pedunculo elongato gracili ovali erecta, operculo conico acuminato, peristomio interno processibus sessilibus dentibus dimidio brevioribus.

Pylacesia tenella, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 770).

S. polyantho S. subdenticulatoque (*Pylacesia* auct.) minor habitu, ramulis copiosis attenuatis primo visu illis *Hypni serpentis* non dissimilibus.

13. S. RENITENS (*Mitten*). Monoicus, caule procumbente pinnato, ramis elongatis laxe cæspitosis, foliis patulis compressis strictis falcatis secundisve ovatis in acumen lanceolatum sensim angustatis concavis, nervis binis brevissimis, margine serrulato, cellulis elongatis angustis alaribus solitariis hyalinis inconspicuis, perichætialibus erectis ovalibus breviter apiculatis serrulatis convolutis, theca in pedunculo elongato

gracili rubro breviter obovata horizontali, operculo conico obtusiusculo, peristomio interno processibus dentium longitudine in membrana ad ¼ dentium exserta, annulo simplici lato.

Hypnum renidens, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, ramulos arborum investiens, alt. 12,000 ped., *J. D. Hooker* (No. 1000).

Species theca brevi horizontali a reliquis sectionis diversa, structura autem convenit. *S. incurvato* (*Hypnum* auct.) proximus.

14. S. SPECIOSUS (*Mitten*). Monoicus, cæspitosus, stramineo nitidus, foliis patentibus ovato-lanceolatis concavis in acumen elongatum subulatum angustatis, nervis binis brevissimis, margine recurvo integerrimo, cellulis angustis alaribus paucissimis parvis fuscis vix conspicuis, perichætialibus erectis elongatis convolutis acumine breviore, theca in pedunculo elongato rubro gracili tortili magna globoso-ovata erecta, operculo brevi convexo-conico abrupte in mamillam contracto, peristomio dentibus breviusculis latis pallidis interno processibus fuscidulis *Bartramiæ* more fissis flexisque dentium longitudine in membrana breviter exserta, sporis magnis amorphis.

Pylacesia speciosa, ex parte, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 765).

Caulis folia staturaque *Hypno salebroso* subsimilia.

15. S. EXTENTUS (*Mitten*). Monoicus, caule decumbente pinnato cæspitoso, foliis patentibus concavis ovato-lanceolatis marginibus recurvis integerrimis brevissime binervatis, cellulis elongatis angustis alaribus parvis subobscuris, perichætialibus interioribus erectis latiusculis apice denticulatis, theca in pedunculo gracili rubro ovali-cylindrica erecta, operculo conico obtusiusculo, peristomio interno e membrana ad dentium medium usque exserta deinde in processus normales divisa.

Pylacesia speciosa, ex parte, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim et Nepal, *J. D. Hooker*! (No. 766, 771).

S. specioso paululum gracilior. *Theca* dimidio minor et pro plantæ magnitudine parva. *Peristomium* internum valde diversum. Cæterum facie generali non multum recedens.

16. S. SIMLAENSIS (*Mitten*). Monoicus, caule repente ramis brevibus conferte pinnato cæspitoso, foliis patentibus subcompressis ovali-acuminatis concavis integerrimis nervis binis brevissimis, cellulis angustis alaribus pluribus parvis obscuris concoloribus, perichætialibus erectis interioribus tribus latis elongatis apice acuminatis patentibus, theca in pedunculo rubro ovali-cylindrica inæquali inclinata.

Hab. In Himalayæ boreali-occident. reg. temp., Simla, *T. Thomson*! (No. 1084).

Habitu et statura *Hypni conferti*, sed *Stereodonti extento* affinis, foliis

magis ovalibus, perichætialibus internis integerrimis, et theca, ex exemplis paucissimis vetustis, diversiformi recedens.

17. S. CAMURIFOLIUS (*Mitten*). Monoicus, caule procumbente pinnato, ramis subhorizontalibus, foliis falcatis secundis e basi contracto-ovatis sensim lanceolatis, nervis binis brevissimis, margine basi serrulato ad medium integerrimo apicem versus minute serrulato, cellulis elongatis angustis alaribus parvis omnibus obscuris, perichætium longissimum foliis latis in cylindrum convolutis apicibus brevi-lanceolatis serrulatis patulo-recurvis, theca in pedunculo longissimo rubro tortili cylindrica erecta, operculo conico acuminato, peristomio interno processibus dentium paululo longioribus e basi fere ad apicem hiante fissis fuscis in membrana ad $\frac{1}{4}$ dentium longitudinis exserta et ad dentium dimidium usque adhærentibus, annulo simplici.

Hab. In Nepal, *Wallich*!

Statura adspectuque *S. imponenti* similis, sed paululum gracilior et florescentia et theca longe alienus.

B. *Theca* suberecta.

** *Peristomium* normale.

18. S. crista-castrensis. (Hypnum, *Linn.*)

Hab. In Himalayæ orient. reg. alp., Sikkim, *J. D. Hooker* (No. 957).

19. S. imponens. (Hypnum, *Hedw.*)

Hab. In Himalayæ reg. temp., Sikkim., *J. D. Hooker* (No. 1063). In Kashmir, *T. Thomson*!

20. S. PERSPICUUS (*Mitten*). Monoicus, caule procumbente rubro dense pinnato, foliis falcatis secundis ovatis concavis sensim longe lanceolatis, nervis fere obsoletis, margine apice subserrulato, cellulis elongatis angustis alaribus magnis oblongis elongatisque hyalinis interioribus paucis intense croceis, perichætialibus valde elongatis, foliis externis e basi lata amplexante subulato-lanceolatis recurvis, internis erectis latis convolutis sensim acutis, theca in pedunculo elongato rubro tortili cylindrica inclinata, operculo conico.

Hypnum Molkenboerianum, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 976).

S. imponenti valde similis, perichætio et florescentia diversus.

21. S. cupressiformis, *Brid.* (Hypnum curvulum, *Wils. in Sched.*)

Hab. Ad Madras, *G. Thomson* (No. 1140). In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 1128). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thompson* (No. 1064).

Specimina sterilia, tamen e structura foliorum huc referenda.

22. S. propinquus. (Hypnum, *Harvey, Hooker, Icon. Plant. Rar.* t. 24.—H. curvulum, *Hooker, Icon. Plant. Rar.* t. 23. f. 7.)

Hab. In Nepal, *Wallich*! In Assam superiore, *Griffith*!

23. S. curvirostris. (Neckera curvirostra, *Schw. t.* 230.)
Hab. In Nepal, *Wallich*! In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! (No. 1086).

24. S. CAPERATUS (*Mitten*). Dioicus, ramis elongatis cæspitosis, foliis compressis erecto-patentibus anguste ovato-lanceolatis longitudinaliter pluries undulatis, margine recurvo integerrimo apiceve subserrulato, nervis binis brevissimis, cellulis elongatis angustis alaribus pluribus parvis concoloribus quadratis pellucidis, perichætialibus erectis, theca in pedunculo elongato gracili ovali-cylindrica suberecta, peristomio interno processibus solidis dentes æquantibus, ciliis binis brevibus interpositis, in membrana ad dentium tertiam partem longitudinis exserta.
Hab. In Himalayæ occidentalis reg. temp., Kumaon, ad vallem Sargu, *Strachey et Winterbottom*!
Habitu staturaque *S. cupressiformi* non dissimilis, foliis autem pluries longitudinaliter undulatis.

25. S. REVOLUTUS (*Mitten*). Cæspitosus, caule procumbente pinnato, foliis falcatis secundis oblongo-ovalibus brevi-late acuminatis pluries longitudinaliter undulatis, nervis binis brevissimis, margine ubique reflexo revolutove, cellulis prosenchymaticis alaribus pluribus parvis quadratis inconspicuis.
Hab. In Tibet. occid. reg. alp., in summo montis Hera La, alt. 18,700 ped., *H. Strachey*!
Statura *S. curvirostris*, habitu omnino formis minoribus *S. cupressiformis* similis, foliis autem latis longitudinaliter undulatis, margine apprime reflexo, cellulis haud elongatis sed brevibus prosenchymaticis satis facile dignoscendus videtur.
Color pallide viridis subnitens, inferne pallide fuscus.

26. S. ERYTHROCAULIS (*Mitten*). Dioicus? caule procumbente frondiformi eleganter bipinnato rubro, foliis patentibus secundis subfalcatis ovatis sensim lanceolatis concavis plicis parvis tenuibus exaratis, nervis binis brevissimis, margine superne serrulato, cellulis elongatis angustis alaribus utrinque circiter tribus oblongo-ovalibus luteis pellucidis, perichætialibus brevibus laxe convolutis serrulatis, theca in pedunculo elongato rubro ovali-cylindrica arcuata inæquali subhorizontali, operculo conico in rostrum breve acuminato, peristomio interno processibus externo æquilongis ciliis singulis brevibus interpositis in membrana ad dentium tertiam partem longitudinis exserta.
Hab. In Himalayæ orient. reg. temp., Sikkim, ad Yeumtong, alt. 12,000 ped., *J. D. Hooker*.
Caulis bi- triuncialis, bipinnatus, ramis semuncialibus curvatis pallidis nitentibus, speciminibus parvis *Hypni splendentis* similis.

27. S. AMBLYOSTEGUS (*Mitten*). Dioicus, cæspitosus, caule procumbente ramis brevibus pinnatim ramoso, foliis compressis strictis falcatis

secundisve ovatis sensim lanceolatis acutis concavis, nervis binis brevibus, margine inferne recurvo superne serrulato, cellulis angustis alaribus pluribus latioribus croceis externis hyalinis, perichætialibus elongatis basi latiusculis sensim lanceolato-attenuatis plicatis apice serrulatis, theca in pedunculo longissimo globoso-ovali erecta inclinatave paululum inæquali, operculo conico, peristomio interno processibus dentium longitudine ciliis binis æquilongis.

Hypnum amblyostegum, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp.; Sikkim, *J. D. Hooker* (No. 972, 973, 974).

Caulis biuncialis, ramis circiter tri- quadri-linearibus apicem versus decrescentibus, foliis fulvis nitentibus, unde primo adspectu formas minores *Hypni fluitantis* simulat, structura foliorum autem ad hanc sectionem pertinet. *Pedunculus* biuncialis.

28. S. NICTANS (*Mitten*). Monoicus, caule repente pinnato dense cæspitoso, foliis compressis patentibus ovatis acuminatis concavis enerviis integerrimis, cellulis elongatis alaribus circiter tribus oblongis flavis, perichætialibus parvis ovato-lanceolatis serrulatis, theca in pedunculo elongato gracili erecta inclinatave ovali-cylindrica, operculo conico acuminato, peristomio interno processibus externo æquilongis ciliis singulis brevibus interpositis in membrana ad tertiam partem dentium longitudinis exserta, annulo simplici.

Hypnum nictans, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 768).

S. lepido similis, gracilior tamen, foliis angustioribus. Formis minoribus *S. cupressiformis* affinis.

29. S. LEPIDUS (*Mitten*). Dioicus? caule procumbente fasciculato pinnato pallido, foliis compressis late ovatis brevi-acuminatis lateralibus complicatis brevissime binervatis, margine superne serrulato, cellulis elongatis alaribus ovalibus concoloribus pellucidis circiter quatuor transverse dispositis æqualibus, perichætialibus parvis ovato-lanceolatis serrulatis vaginulam non tegentibus, theca in pedunculo elongato gracili rubro horizontali ovali inæquali, operculo subulato capsulæ dimidium æquante, peristomio interno processibus externo æquilongis ciliis binis interpositis in membrana ad quartam partem dentium longitudinis exserta.

Hypnum lepidum, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 1039, 1101).

Foliorum latitudine et compressione ab affinibus recedens, structura autem conveniens.

30. S. palustris, *Brid.*

Hab. In Tibet. occid. reg. temp., *T. Thomson* (No. 954, 987).

31. S. CREPERUS (*Mitten*). Monoicus, caule longe repente filiformi laxe pinnato, foliis imbricatis late ovatis in apiculum acuminatis, nervis

binis brevibus, margine inferne planiusculo superne serrulato, cellulis elongatis alaribus vix albis conspicuis, perichætialibus erectis latis convolutis apice acuminatis serrulatis, theca in pedunculo elongato cylindrica inclinata arcuata, operculo conico acuminato.

Hypnum creperum, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. alp., Sikkim, *J. D. Hooker* (No. 1122).

Gracilis. *Caulis* biuncialis, filiformis et primo intuitu pro stolone potius quam pro planta autonoma sumendus.

32. S. CELATUS (*Mitten*). Gracilis, repens, ramis curvatis, foliis patentibus strictis subsecundisve ovalibus acuminatis concavis dorso papillosis, margine planiusculo apicem versus serrulato, enerviis, cellulis angustis alaribus paucis quadratis oblongisque pellucidis.

Leskea polyantha, *Harvey*, excl. fig. in *Hook. Icon. Plant. Rar.* t. 23. f. 3, quæ folia *S. aurei* repræsentat.

Hab. In Nepal, inter cæspites *S. aurei*, sterilis, *Wallich*!

Species parva, *S. pallescenti* (*Hypnum*, Sw.) habitu et statura similis.

33. S. Fabronia. (Hypnum, *Hook.*—Helicodontium, *Schw.* t. 294.)

Hab. In Nepal, *Wallich* !

C. *Theca* pendula.

34. S. Buitenzorgii. (Hypnum, *Bél.*)

Hab. In Ceylon, *Gardner* (No. 168).

35. S. ichnotocladum. (Hypnum, *C. Müller, Synops.* ii. p. 301.)

Hab. In Himalayæ orient. reg. temp., Sikkim (inter cæspites *Bartramiæ longicollis* repens), *J. D. Hooker* ! (fragmenta).

36. S. COMPRESSIFOLIUS (*Mitten*). Dioicus? caule procumbente elongato, ramis æqualibus apicem versus decrescentibus plumiformipinnatis, foliis caulinis compressis falcatis ovatis basi truncatis sensim acutis nervis obsoletis margine superne serrulato, cellulis angustis elongatis alaribus nullis, rameis applanatis ovatis ovalibus ellipticisve lateralibus complicatis serrulatis, perichætialibus e basi subovali longe lanceolato-attenuatis integerrimis, theca in pedunculo elongato gracili ovali horizontali pendulave, operculo conico brevi-rostrato, peristomio interno processibus ciliisque binis interpositis in membrana ad quartam partem dentium longitudinis exserta.

Hab. In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 1049, 1091, 1166, 1179). In Assam superiore, ad Suddya, *Griffith* ! Ad Moulmein, *Parish* !

S. ichnotoclado similis, sed robustior. *Caulis* 2–4-uncialis, pallidus. *Folia* læte-viridia; ramea non falcata, sed deplanata.

37. S. cyperoides. (Hypnum, *Hook. Icon. Plant. Rar.* t. 23. f. 5.—H. ambiguum, *Harvey, Hook. Icon. l. c.* t. 24. f. 4.)

Hab. In Nepal, *Wallich* ! In Ceylon, *Thwaites* ! *et Gardner* (No. 971, 1024, 1070 *b*, 1075).

Variat foliorum latitudine, nunc foliis ovatis sensim acutis=*H. ambiguum*, nunc ovato-lanceolatis, etiam nonnunquam superne subulato-lanceolatis. Monoicus.

38. S. ROSTELLATUS (*Mitten*). Dioicus, caule procumbente, ramis brevibus approximatis pinnatis, foliis falcatis secundis ovatis in acumen lanceolatum angustatis rameis ovalibus lanceolatisque brevissime binervatis marginibus serrulatis, cellulis angustis elongatis alaribus inconspicuis, perichætialibus erectiusculis longe attenuatis remote serrulatis, theca in pedunculo elongato rubro ovali horizontali, operculo conico rostello angusto, peristomio processibus dentium longitudine ciliis binis ut plurimum in unum coalitis brevioribus in membrana ad $\frac{1}{4}$ dentium longitudinis exserta.

Hab. In Himalaya temperata, Nepal, *Wallich*! *et J. D. Hooker*! (No. 1067).

Folia, quamvis fere ejusdem formæ ac in *S. cyperoide* (quocum habitu et statura valde est affinis), minus depressa. *Caulis* minus regulariter pinnatus.

39. S. CYGNICOLLUM (*Mitten*). Monoicus, caule procumbente pinnato, foliis subcompressis subfalcatis subsecundis ovatis sensim lanceolato-attenuatis concavis, nervis binis paulo infra medium evanidis margine serrulato paululum recurvo, cellulis angustis elongatis alaribus paucis una tantum majore hyalina, perichætialibus patulis longius attenuatis serrulatis, theca in pedunculo elongato rubro apice curvato ovali horizontali pendulave, operculo brevi conico acuto, peristomio processibus ciliisque solitariis dentium longitudine in membrana ad tertiam partem dentium longitudinis exserta.

Hab. In Himalayæ orient. reg. temp., inter *Leskeas capillatas*, Sikkim, *J. D. Hooker*! (No. 1123).

S. cyperoidi simillimus, sed foliis minus compressis, nervis longioribus.

40. S. CLARESCENS (*Mitten*). Dioicus? cæspitosus, caule elongato procumbente, ramis arcuatis irregulariter pinnatis, foliis paululum compressis patentibus subimbricatis ovatis acuminatis nervis binis infra medium evanidis marginibus superne serrulatis undulatisque, cellulis angustis alaribus inconspicuis, perichætialibus ovatis longe subulatis, theca in pedunculo longissimo apice curvato ovali horizontali, operculo conico acuminato, peristomio interno processibus dentium longitudine ciliis binis brevioribus interpositis in membrana ad $\frac{2}{5}$ dentium longitudinis exserta.

Hypnum clarescens, affine H. serrato *Beauv.* (an H. malacobolum *C. Müller*?), *Wils. in Sched.*

Hab. In Himalayæ boreali-occident. reg. temp., Simla, *T. Thomson* (No. 1064 *b*).

Caulis biuncialis. Habitu adspectuque *S. Nepalensis*, sed robustior.

41. S. Nepalensis. (Hypnum, *Hook.*)

Hab. In Nepal et in collibus "Garrow Hills" Bengaliæ, *Wallich*!

42. S. punctulatus. (Hypnum, *Harvey, Hook. Icon. Plant. Rar.* t. 23. f. 10.)

Hab. In India orient., *Wallich*! Ad Madras, *Wight*!

43. S. LEIOPHYLLUS (*Mitten*). Monoicus, foliis compressis ovato-lanceolatis subserrulatis breviter binervatis, cellulis angustis lævibus, perichætialibus patulis lanceolatis serrulatis, theca in pedunculo elongato parva ovali inæquali horizontali pendulave.

Hab. In Ceylon, *Gardner*!

S. punctulato simillimus, sed foliis cellulis haud punctulatis et statura minore differt.

44. S. stissophyllus. (Hypnum, *Hampe.*)

Hab. In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 1071 *b*). In Ceylon, *Gardner* (No. 1026).

45. S. TUBERCULATUS (*Mitten*). Monoicus, caule repente pinnato, ramis brevibus assurgentibus, foliis undique patentibus ovato-lanceolatis sensim acuminatis integerrimis enerviis, cellulis elongatis angustis alaribus nullis, perichætialibus lanceolatis suberectis integerrimis, theca in pedunculo breviusculo lævi ovali cellulis prominentibus subtuberculatove flexura pedunculi horizontali cernuave, operculo conico acuminato, peristomio interno ciliis nullis?

Hab. In Ceylon insula, *Gardner.*

Habitu fere *S. punctulati.*

46. S. reticulatus, *Dozy et Molk.* (Hypnum scintillans, *Wils. in Sched.*)

Hab. In Himalayæ reg. temp., Nepal, *Wallich*! Sikkim, *J. D. Hooker* (No. 977, 1067 ex parte). In Assam superiore, *Griffith*!

47. S. SUCCOSUS (*Mitten*). Monoicus, caule prostrato subpinnato, foliis patentibus compressis asymmetricis ovatis longiuscule tenuiter acuminatis planiusculis margine paululum recurvo apicem versus minute serrulato apiculo lævi, nervis binis pallidis brevibus, cellulis oblongis laxis, perichætialibus e basi suberecta lata longe subulato-attenuatis patulis apice subserrulatis, theca in pedunculo rubro oblonga nutante, operculo depresso conico brevi-rostrato.

Hypnum vesiculare, *Wils. in Sched.*

Hab. In Nepal orient. reg. temp., *J. D. Hooker* (No. 1038).

S. reticulato similis, sed foliis acumine longiore et cellulis paululum longioribus.

D. *Theca* longirostrata.

48. S. orthothecius. (Hypnum, *Schw.* t. 220.—Leskea secunda, *Hook. Icon. Plant. Rar.* t. 23. f. 1.)

Hab. In Nepal, *Wallich*! In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 1090).

Folia ovali-lanceolata, margine recurvo; cellulæ alares paucissimæ. *S. cæspitoso* (*Leskea*, Swartz) similis, sed minor.

49. S. TRISTICULUS (*Mitten*). Monoicus, caule repente ramis brevibus subpinnatim ramoso, foliis patentibus oblongo-ovatis cochleariformi concavis margine plano integerrimo nervis binis brevissimis obsoletisve, cellulis angustis alaribus trinis pallidis, perichætialibus erectis longioribus integerrimis, theca in pedunculo brevi fusco ovali suberecta, peristomio dentibus latiusculis luteis processibus æquilongis ciliis nullis.

Hypnum sphærotheca, *Wils. in Sched.*

Hab. In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 1087). In Assam superiore, *Griffith*! In Ceylon, *Gardner* (No. 1034).

S. *Kegeliano* (*Hypnum*, C. Müller) similis, parum robustior, sordide luteo-viridis.

50. S. CONFERTISSIMUS (*Mitten*). Monoicus, humilis, cæspitosus, foliis patentibus ovatis acutis marginibus superne serrulatis basi incurvis amplexantibus nervis binis brevissimis, cellulis elongatis angustis alaribus utrinque circiter tribus, perichætialibus lanceolatis elongatis erectis, theca in pedunculo breviusculo ovali nutante, operculo subulato-rostrato theca longiore.

Hab. In Assam superiore (mont. Khasian. ?) ad Moosmai, *Griffith*!

S. *orthothecio* minor, foliorum cellulis alaribus distinctis diversus. *Rami* circiter trilineares. *Pedunculus* quadrilinearis.

51. S. Harveyanus. (Leskea curvirostra, *Harvey, Hook. Icon. Plant. Rar.* t. 20. f. 1.)

Hab. In Nepal, *Wallich*!

52. S. humilis. (Hypnum humile, *Harvey, Hook. Icon. Plant. Rar.* t. 23. f. 9.)

Hab. In Nepal, *Wallich*!

53. S. subhumilis. (Hypnum, *C. Müller, Synops.* ii. p. 330.)

Hab. In Mont. Nilghiri, *Perrottet*!, *Schmid.*

54. S. brachypelma, *C. Müller, Synops.* ii. p. 404. (Hypnum microcarpum, *Hook. Icon. Plant. Rar.* t. 23. f. 4.)

Hab. In Nepal, *Wallich.*

55. S. leptocarpus. (Hypnum. *Schwægr.* t. 316.)

Hab. In Ceylon, *Gardner* (No. 1044, 1066). Etiam in Java, *Reinwardt*!

56. S. rostratus. (Neckera, *Griff. Not.* p. 456; *Icon. Plant. Asiat.* ii. t. 87. f. 1.)

Hab. In mont. Khasian. reg. temp. *J. D. Hooker et T. Thomson* (No. 779, 1029). In sylvis ad Myrung, *Griffith*!

Species monoica, cæspitosa, foliis imbricatis congestis ellipticis paululum acuminatis concavis dorso lævibus margine plano integerrimo angusto recurvo brevissime binervatis, cellulis elongatis angustis alaribus inferioribus oblongis parallelogrammaticis superioribus rotundatis fusci-

dulis, perichætialibus lanceolatis sensim angustatis erecto-patentibus, theca in pedunculo elongato ovali-cylindrica erecta inclinatave, operculo subulato subæquilongo, peristomio ?

57. S. GLAUCO-VIRENS (*Mitten*). Monoicus, cæspitosus, habitu *S. rostrati*, foliis ellipticis breviter acuminatis apice subtortis dorso papillosis margine plano superne serrulato nervis binis brevissimis, cellulis angustis alaribus majoribus elongato-oblongis in serie unica transverse ad basin tantum dispositis fuscidulis, perichætialibus erecto-patentibus ovatis acumine late lanceolato subobtuso argute serrulato, theca in pedunculo breviusculo superne ruguloso parva ovali horizontali.

Leskea, No. 5, *Griffith*.

Hab. In Assam superiore, ad Gowgong, *Griffith* !

S. rostrato minor, opacior, foliis dorso papillosis margine serrulatis et theca horizontali diversus.

58. S. LEPTORHYNCHOIDES (Hypnum, *Mont. in litt.*). Monoicus, habitu *S. leptorhynchi*, caule rubro, foliis e basi ovato-lanceolata sensim longe attenuatis superne serrulatis margine uno latere recurvo, cellulis angustis alaribus trinis quaternisve magnis fuscis, perichætialibus erecto-patulis curvatis elongatis angustis serrulatis, theca in pedunculo elongato rubro ovali horizontali pendulave, peristomio dentibus luteis valde trabeculatis interno processibus æquilongis ciliis singulis (?) interpositis.

Hab. In mont. Nilghiri, *Perrottet* !

Species ab affinibus, foliis perichætialibus longe lanceolatis attenuatis serrulatis, recedens.

ii. *Plagiothecium*, Schimp.

59. S. PALEACEUS (*Mitten*). Dioicus ? ramis basi procumbentibus arcuatis parce ramosis, foliis subsecundis patulis planiusculis orbiculari-ovatis acutis nervis brevissimis margine integerrimo, cellulis elongatis angustis alaribus laxioribus brevioribus hyalinis in caule utrinque decurrentibus, perichætialibus erectis brevibus oblongis apiculatis, theca in pedunculo elongato gracili ovali-cylindrica erecta, operculo conico acuminato, peristomio pallido interno processibus solidis in membrana ad dentium tertiam partem longitudinis exserta.

Leskea paleacea, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp. et alp., Sikkim, *J. D. Hooker* (No. 1006, 1007, 1075).

Pallide stramineus nitidus. *Rami* unciales. *Folia* brevia, ad unum latus spectantia. A reliquis *Plagiotheciis*, foliis orbiculari-acuminatis, facile cernendus.

60. S. neckeroideus. (Plagiothecium, *Schimp. Bryol. Europ.*)

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* ! (No. 1008, 1010, 1048).

61. S. Donianus. (Hypnum, *Smith.*)
Hab. In Himalayæ orient. reg. alp., Sikkim, *J. D. Hooker* (No. 1005).

62. S. denticulatus, *Brid.*
Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 1009).

63. S. NEMORALIS (*Mitten*). *S. sylvatico* simillimus, sed foliis elliptico-ovatis latioribus, cellulis paululum minoribus.
Hab. In Himalayæ orient. reg. temp., Sikkim, in monte Tonglo (ad radicem filicis cujusdam), *J. D. Hooker* !

iii. *Taxicaulis,* C. Müller.

64. S. LIGNICOLA (*Mitten*). Monoicus, laxe stratus, ramis decumbentibus simplicibus, foliis patentibus ovatis longe tenuiter subulato-acuminatis enerviis integerrimis, cellulis teneris angustis albidis alaribus vix distinctis, perichætialibus lanceolatis subulatis patulis, theca ovali æquali flexura pedunculi gracili horizontali, ore magno, peristomio interno ciliis solitariis brevibus.
Hab. In Moulmein (in arborum truncis emortuis), *Rev. D. Parish* !
Species pusilla, habitu staturaque *S. albescentis,* foliis tamen sensim longe acuminatis haud compressis, et theca æquali pedunculi flexura horizontali.

65. S. albescens. (Hypnum, *Schw.* t. 226.)
Hab. In Nepal, *Wallich* ! In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* ! (No. 1079). In mont. Nilghiri, *Schmid.*

66. S. ASSAMICUS (*Mitten*). Monoicus, parvulus, foliis ovatis asymmetricis acuminatis brevissime binervatis margine integerrimo, cellulis elongatis angustis alaribus inconspicuis, perichætialibus patulis tenuiter longo-acuminatis integerrimis, theca in pedunculo elongato parva ovali horizontali, operculo conico.
Hab. In Assam, *Griffith* !
S. albescenti valde similis, sed foliis apiculo breviore latiore et margine integerrimo.

67. S. LONGITHECA (*Mitten*). Dioicus, caule procumbente ramoso laxe cæspitoso, foliis compressis patulis ovatis sensim acutis enerviis margine superne parce subserrulatis, cellulis angustis elongatis alaribus utrinque quaternis elongatis latis pellucidis, perichætialibus laxis erectis superne serrulatis, theca in pedunculo elongato suberecta inclinatave cylindrica, operculo conico-subulato, peristomio interno processibus dentium longitudine ciliis unicis brevioribus interpositis in membrana ad $\frac{1}{4}$ dentium longitudinis exserta.
Hypnum nictans, var., *Wils. in Sched.*
Hab. In Himalayæ orient. reg. temp., Sikkim (in arborum ramis putridis). *J. D. Hooker* (No. 1152).

S. albescenti affinis, sed foliis acumine breviore cellulis alaribus distinctis et theca cylindrica recedens.

68. S. PALLIDULUS (*Mitten*). Monoicus, caule procumbente ramoso, foliis compressis laxis pallidis ovatis sensim acutis, nervis binis brevissimis integerrimis, cellulis elongatis angustis, perichætialibus ovatis subulato-attenuatis recurvis, theca in pedunculo elongato ovali horizontali, operculo conico, peristomio interno processibus externo æquilongis ciliis binis breviusculis interpositis in membrana ad $\frac{1}{3}$ dentium longitudinis exserta.

Hab. In Himalaya occid., Kumaon, ad terram, *Strachey et Winterbottom*!

Caulis semuncialis, prostratus, gracilis. Statura *S. albescenti* subsimilis, foliis nitidis remotioribus et operculo breviore.

69. S. DISTICHACEUS (*Mitten*). Monoicus, prostratus, caule vage ramoso, ramis elongatis, foliis distichaceo-compressis divergentibus elliptico-lanceolatis planis apice serrulatis parum asymmetricis enerviis, cellulis elongatis angustis alaribus nullis, perichætialibus parvis lanceolatis vaginam vix tegentibus integerrimis, theca in pedunculo elongato parva ovali horizontali, operculo conico, peristomio processibus ciliisque æquilongis interpositis.

Hab. In Nepal, *Wallich*! In Himalaya boreali-occident., *Royle*!

S. deplanato (*Hypnum*, Schimp.) habitu similis, sed foliis angustioribus.

70. S. TAXIRAMEUS (*Mitten*). Dioicus? prostratus, caule vage ramoso, foliis distichaceo-compressis divergentibus e basi asymmetrica ovato-lanceolatis subplanis nervis binis ad $\frac{1}{3}$ evanidis margine ubique serrulato, cellulis angustis alaribus nullis, perichætialibus parvis lanceolatis subulato-attenuatis subserrulatis, theca in pedunculo elongato parva ovali horizontali.

Hab. In Himalayæ reg. temp., Simla et Kumaon, *T. Thomson*! (No. 1008, 1023 *b*). In Nepal, *J. D. Hooker*! In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! In Assam superiore, *Griffith*! In Ceylon, *Gardner*!

Præcedenti habitu staturaque simillimus, sed foliorum forma, nervis, et florescentia, ut videtur, diversus.

71. S. IVOREANUS (*Mitten*). Caule procumbente, ramis vagis, foliis patulis compressis deplanatis ovato-linguæformibus obtusissimis paululum asymmetricis nervis binis brevibus margine apice argute serrulato, cellulis omnibus angustis elongatis.

Hab. In Nepal, *Wallich*! In mont. Nilghiri, *McIvor*.

Primo visu *Omaliæ trichomanoidi* statura coloreque similis, sed foliorum structura cellulis linearibus alienus. A *S. lancifolio* foliis brevioribus cellulis alaribus nullis diversus.

iv. *Cuspidaria.*

Rami foliis pungentibus cuspidati.

72. S. turgidus. (Hypnum, *Dozy et Molk. Ann. des Sc. Nat.* 1844, ii. p. 809.—H. hyalinum, *Wils. in Sched.*)
Hab. In Ceylon, *Gardner* (No. 785, 786).

73. S. præmollis. (Hypnum, *C. Müller, Synops.* ii. p. 671.—Leskea cirrhifolia, *Wils. in Sched.*)
Hab. In Ceylon, *Gardner*! In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! (No. 774, 854).

74. S. Braunii. (Hypnum, *C. Müller, Synops.* ii. p. 687.—H. hyalinum, *Wils. in Sched.*)
Hab. In Ceylon, *Gardner* (No. 784).

75. S. ACUTIRAMEUS (*Mitten*). Monoicus, caule cæspitoso vage pinnato, ramis cuspidatis, foliis patentibus laxe imbricatis elliptico-ovatis sensim acutis integerrimis enerviis, cellulis elongatis alaribus circiter quinis elongatis coloratis, perichætialibus erectis superne serrulatis, theca in pedunculo elongato superne ruguloso eroso suberecta ovali, operculo longirostrato.
Hab. In Ceylon, *Gardner*! In mont. Khasian., ad Moflong, in pinetis, *Griffith*!
S. Braunii simillimus, sed foliis angustioribus et florescentia diversa.

76. S. Gedeanus. (Hypnum, *C. Müller, Synops.* ii. p. 390.)
Hab. In Ceylon, *Gardner*!

v. *Cylindrothecium*, Schimp.

77. S. ANGUSTIFOLIUS (*Mitten*). Ramis pinnatis, foliis compressis patentibus, anguste ovato-lanceolatis in apicem angustum attenuatis basi contractis margine integerrimis uno latere complicato-inflexis nervis binis brevibus, cellulis elongatis alaribus paucis quadratis pellucidis pallidis inconspicuis, perichætialibus erectis strictis late lanceolatis convolutis anguste acuminatis.
Hab. In Himalayæ orient. reg. temp., Sikkim, alt. 9000 ped., in monte Lachen (*Ptychantho striato* irrepens), *J. D. Hooker*!
S. macropodo (*Neckera* auct.) similis, sed foliis longioribus apice angustioribus.

78. S. plicatus. (Neckera plicata, *C. Müller, Synops.* ii. p. 60.—Pterogonium aureum, *Griff. Not.* p. 449, ex specimine in Herb. Ward.)
Hab. In Himalaya temp., Nepal, *Wallich*! *J. D. Hooker* (No. 738, 746); Sikkim, *J. D. Hooker* (No. 745, 747, 750); in reg. trop. (No. 721). Kumaon, *Strachey et Winterbottom.* In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 731, 743, 744, 748, 753). In Assam, *Griffith*! In mont. Nilghiri, *Perrottet*! *Mc Ivor*! *Schmid.* Ad Madras, *Wight*! In Ceylon, *Gardner* (No. 755).

79. S. LÆTUS (*Mitten*). Monoicus, caule ramis brevibus pinnato, foliis compressis patentibus laxe imbricatis ovato-ellipticis acutis concavis lateralibus complicatis basi latiusculis, nervis binis brevibus, marginibus integerrimis, cellulis elongatis angustis alaribus pluribus quadratis pallidis pellucidis, perichætialibus erectis basi convolutis latiusculis apice acuminatis obtusiusculis, theca in pedunculo elongato rubro cylindrica, operculo subulato-rostrato, peristomio dentibus brevibus processibus dimidio brevioribus.

Neckera læta, *Griff. Not.* p. 459; *Icon. Plant. Asiat.* ii. t. 87. f. 7.?—N. nitida, *Wils. in Sched.*

Hab. In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! (No. 756).

Rami biunciales, tenelli; ramuli bi- trilineares. Plantam Griffithianam non vidi, sed, e descriptione et icone, cum speciminibus No. 756 satis convenire videtur.

80. S. Gardneri. (Pterogonium myurum, *Hook. Musc. Exot.* t. 144.)

Hab. In Himalaya temperata, Nepal, *Gardner*! Kumaon, *Strachey et Winterbottom*! *T. Thomson*! Simla, *T. Thomson* (No. 735, 735 *b*, 736, 737) *et Royle*!

81. S. PROREPENS (*Mitten*). Monoicus, caule elongato iterum iterumque arcuato radicante ramis flexuosis curvatis pinnato, foliis late ovatis acutis integerrimis brevissime binervatis concavis, cellulis angustis elongatis alaribus pluribus brevibus pallidioribus per folii basin transverse protractis, perichætialibus internis erectis e basi lata ovata lanceolatis subintegerrimis, theca in pedunculo rubro cylindrica interdum arcuata ætate plicata, operculo conico rostrato, peristomio externo dentibus fuscis interno processibus luteis e membrana brevissima orientibus.

Hab. In Himalaya temperata, Nepal, *Wallich*! *J. D. Hooker*! (No. 752). Kumaon, *Royle*! *T. Thomson* (No. 777 *b*). In Assam, *Griffith*!

S. myuro simillimus, sed gracilior minusque procerus, foliis cellulis alaribus per basin protractis, quæ in foliis *S. myuri* ad angulos tantum aggregatæ sunt.

82. S. THOMSONI (*Mitten*). Monoicus, caule procumbente ramis curvatis pinnatim ramoso, foliis ovali-oblongis acutis integerrimis concavis breviter binervatis, cellulis angustis elongatis alaribus pluribus parvis quadratis concoloribus, perichætialibus e basi late ovata lanceolatis integerrimis patulis, theca in pedunculo rubro ovali-oblonga erecta interdum arcuata, operculo conico rostrato, peristomio externo dentibus rubris interno processibus paulum brevioribus angustis luteis e membrana angustissima orientibus, annulo simplici, columella exserta.

Neckera myura, var., *Wils. in Sched.*

Hab. In Himalayæ boreali-occident. reg. temp., Simla, *T. Thomson*! (No. 777) *et Royle*!

Habitu fere *S. prorepentis*, sed structura foliorum caulinorum et perichætii etiam peristomii diversus.

83. S. RUBICUNDUS (*Mitten*). Foliis teretiuscule imbricatis ambitu ovatis acutis basi subito angustatis breviter binervatis ut plurimum uno latere complicato-inflexis superne subserrulatis, cellulis elongatis angustis alaribus pluribus parvis quadratis oblongisve pallidis pellucidis mollibus, perichætialibus ovato-lanceolatis erectis apicibus patulis superne subserratis, theca in pedunculo longissimo rubro cylindrica erecta, operculo conico rostrato, peristomio dentibus elongatis angustis rubro-aurantiacis processibus concoloribus dentibus triente brevioribus, annulo simplici.

Neckera flavescens, *Hook. Trans. of Linn. Soc. Lond.* ix. p. 314, t. 27. f. 2.—Cylindrothecium rubicundum, *Wils. in Sched.*—N. coarctata, *C. Müller*, ex parte, *Synops.* ii. p. 69.—N. rubicunda, *Wils. in Sched.*

Hab. In Himalayæ reg. temp., Nepal, *Wallich*! Sikkim, *J. D. Hooker*! (No. 751). In Assam, *Griffith*!

S. Montagnei (*Cylindrothecium*, Schimp.) valde similis, sed foliis acutioribus.

84. S. CALIGINOSUS (*Mitten*). Habitu facieque *S. Hookeri*, foliis ovatis obtusiusculis iis *S. Montagnei* similibus, cellulis autem dimidio brevioribus alaribus obscuris.

Cylindrothecium Montagnei, var., *Wils. in Sched.*

Hab. In Nepal orient. reg. temp., *J. D. Hooker*! (No. 751 *b*).

Species distincta, cujus specimina pauca incompleta tantum vidi.

85. S. SCHWÆGRICHENI (*Mitten*). Monoicus, ramis bipinnatis ramulis elongatis divaricatis, foliis ovatis basi subito angustatis apice sensim in acumen lanceolatum attenuatis concavis nervis binis brevissimis margine integerrimo, cellulis elongatis angustis alaribus pluribus quadratis pallidis pellucidis, perichætialibus basi ovalibus subulato-lanceolatis integerrimis, theca in pedunculo breviusculo pallido cylindrica, operculo conico acuminato, peristomio dentibus rubris processibus brevioribus, annulo simplici.

Neckera flavescens, *Schwægr.* t. 141.—N. coarctata, *C. Müller, Synops.* ii. p. 69.

Hab. In Nepal, *Wallich.*

Habitu e ramulis elongatis divaricatis a *S. Hookeri* recedens; foliis apice lanceolatis subacuminatis et florescentia satis distinctus.

86. S. GRIFFITHII (*Mitten*). Dioicus, foliis late ovatis paululum acuminatis acutis margine subserrulatis nervis binis brevissimis, cellulis angustis alaribus pluribus quadratis pallidis pellucidis, perichætialibus e basi ovali erecta subulato-lanceolatis integerrimis patulis, theca in pedunculo elongato rubro cylindrica ætate plicata, operculo conico rostrato, peristomio *S. Hookeri.*

Hab. In Assam superiore, *Griffith*!

S. Hookeri valde affinis, sed paululum gracilior, foliis latioribus basi minus subito angustatis minus complicatis apiceque paululum acuminatis.

87. S. curvatus. (Neckera, *Griff. Not.* p. 451; *Icon. Plant. Asiat.* ii. t. 86. f. 1.)

Hab. In mont. Khasian. reg. temp., ad Bogapanee, in rupibus prope torrentem, *Griffith.*

88. S. luridus. (Neckera, *Griff. Not.* p. 452.)

Hab. In mont. Khasian. reg. temp., ad Surureem, rupestris, *Griffith.*

89. S. pulchellus. (Neckera, *Griff. Not.* p. 453; *Icon. Plant. Asiat.* ii. t. 87. f. 6.)

Hab. In mont. Khasian. reg. temp. in sylvis Mumbree, *Griffith.*

90. S. comes. (Neckera, *Griff. Not.* p. 458; *Icon. Plant. Asiat.* t. 86. f. 2.)

Hab. In mont. Khasian. frequens, *Griffith*! In Ceylon, *Gardner*! In Himalayæ orient. reg. alp., Sikkim (No. 776), et in reg. temp. (No. 881), *J. D. Hooker.*

Pulcherrimus, stramineo-fuscus, nitidus, ramis laxe pinnatis, foliis laxis patentibus ovali-ellipticis acutis acuminatisve, inflexura marginis subtubulosis indistincte binervatis margine superne serrulatis, cellulis angustis alaribus paucis parvis fuscis, perichætialibus erectis e basi laxe convoluta lanceolatis apice serrulatis, theca in pedunculo brevi gracili ovali erecta, operculo (ex Griffithio) subulato curvato, peristomio interno processibus angustis dentibus brevioribus papillosis in membrana brevissima subsessilibus, calyptra cucullata.

Hujus speciei specimina authentica paucissima vidi; Hookeriana non omnino inter se et cum Griffithianis congruunt. An ad species diversas affines, an ad unam variantem pertinent, e materia elucidari nequit.

91. S. FULVONITENS (*Mitten*). Caule elongato flexuoso vage pinnato, foliis laxe imbricatis late ovatis apice latiusculo-rotundatis inflexura marginum concavis, margine basi anguste recurvo apice minute serrulato, nervis binis infra medium evanidis, cellulis angustis alaribus vix ullis.

Hab. In Nepal, *Wallich*!

Pulchre stamineo-fuscus, nitidus; statura in specimine unico triuncialis; ramis uncialibus crassitudine *Leskeæ molli* (Hedw.) similis, sed colore *L. flexilis* (Hedw.) et *Neckeræ comitis* (Griff.). Foliorum forma iis *Cylindrothecii Montagnei* (Schimp.) fere exacte congruit; sed, caule vel vagante vel pendulo flexuoso ex habitu et structura speciei, *S. comiti* affinis videtur.

92. S. NUBIGENA (*Mitten*). Ramis cæspitosis laxe pinnatis, foliis patulis elliptico-ligulatis concavis apice apiculo recurvo mucronatis nervo unico sub apicem evanido, cellulis angustis elongatis alaribus parvis brevibus pallidioribus.

Hypnum sarmentosum, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. alp., Sikkim, *J. D. Hooker* (No. 1045).

A *S. sarmentoso*, primo adspectu maxime similis, foliis angustis apiculo recurvo mucronatis cellulis longioribus alaribusque parvis fere homomorphis certe distinctus.

93. S. Schreberi. (Hypnum, *Willd.*—H. macilentum, *Wils. in Sched.*)
Hab. In Himalayæ orient. reg. alp., Sikkim, *J. D. Hooker* (No. 1164).
Sterilis. A forma vulgari Europæa vix, nisi ramis gracilioribus, differt.

vi. *Symphyodon*, Mont.

94. S. Perrottetii. (Symphyodon, *Mont. Syllog.* p. 20.)
Hab. In mont. Nilghiri, *Perrottet*! *Schmid*! In Ceylon, *Gardner* (No. 756) *et Thwaites*!

95. S. lancifolium. (Neckera, *Harvey, Hook. Icon. Plant. Rar.* t. 21. f. 5.)
Hab. In Nepal, *Wallich*!

96. S. angustus. (Neckera, *C. Müller, Synops.* ii. p. 67.)
Hab. Ad Bombay, *Kegel.*

97. S. ERINACEUS (*Mitten*). Dioicus, caule——? ramis subpinnatis laxis, foliis oblongo-ellipticis oblongo-ovatisve marginibus superne tenuissime serrulatis basin versus paululum recurvis breviter binervatis, cellulis angustis lævibus conformibus, perichætialibus lanceolatis patentibus, theca in pedunculo gracili rubro aspero ovato-oblonga echinata.
Symphyodon Perrottetii, var., *Wils. in Sched.*
Hab. In mont. Khasian. reg. trop., *J. D. Hooker et T. Thomson* (No. 833).
S. angusto major, procerior, foliis superne latioribus ramulinis elongato-ovalibus obtusiusculis.

98. S. ASPER (*Mitten*). Dioicus? caule repente, ramis pinnatis ramulis inordinatim elongatis, foliis elongato-ovatis obtusiusculis marginibus superne serrulatis nervis binis brevibus, ramulinis enerviis, cellulis elongatis lævibus conformibus, perichætialibus erectis lanceolato-subulatis serrulatis, theca in pedunculo gracili rubro superne scabro ovali-cylindrica operculoque conico rostrato spiculis brevibus aspero, peristomio externo dentibus lævibus tenuiter elongatis interno processibus fuscis angustissimis ad dentium dimidium attingentibus, membrana basilari subnulla, annulo parvo composito.
Symphyodon Perrottetii, var., *Wils. in Sched.*
Hab. In mont. Khasian. reg. trop., *J. D. Hooker et T. Thomson*! (No. 772, 866).
S. Perrottetii gracilior, ramulis inordinatis magis confertis.

99. S. ECHINATUS (*Mitten*). Dioicus, caule repente, ramis bipinnatim ramosis dendroideis, foliis patentibus latissime ovatis fere ad medium binervatis marginibus superne serrulatis ramulinis magis concavis breviter nervatis, cellulis angustis dorso papilloso-scabris, perichæ-

tialibus erecto-patentibus lanceolatis serrulatis, theca in pedunculo elongato rubro superne scabro ovali-cylindrica ubique spiculosa, peristomio dentibus tenuiter elongatis processibus angustis pallidis ultra medium dentium protractis iisque adhærentibus.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 734).

A speciebus alteris ramis pluriramulosis compactioribus et peristomio interno externo adhærente recedit.

100. S. ERRATICUS (*Mitten*). Caule procumbente bi- tripinnatim ramoso sæpe ramis vagis elongatis gracili, foliis caulinis erecto-patentibus late ovato-lanceolatis nervis binis infra medium evanidis margine serrulato inferne recurvo rameis ramulinisque ovatis brevi binervatis serrulatis, cellulis angustis dorso sparse papillosis.

Hab. In Himalayæ reg. temp., Nepal, *Wallich*! *J. D. Hooker* (No. 1067), Sikkim, *J. D. Hooker.* In Ceylon, *Gardner*!

Caulis inter muscos longe repens vage ramosus, foliis compressiusculis rufo-fusco tinctis subnitentibus. *S. aspero* statura similis, sed foliis caulinis magis ovato-lanceolatis, ramulinis nervatis.

101. S. PLANULUS (*Mitten*). Caule repente, ramis frondiformibus bipinnatis ramulis sæpe attenuatis microphyllis, foliis patentibus ovato-lanceolatis subulato-acutis integerrimis marginibus fere oblique reflexis nervis binis brevissimis, perichætialibus parvis erecto-patentibus conformibus, theca in pedunculo gracili tortili flexuoso ovata subglobosave, operculo conico brevi-rostrato, peristomio dentibus pallidis processibus angustis æquilongis e membrana brevi ortis.

Lescurea marginata (forsan Neckera clastobryum), *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., *J. D. Hooker* (No. 764). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! (No. 753 *b*).

Primo adspectu formis brevibus *Neckeræ complanatæ* subsimilis. Lævitate thecæ et pedunculi a congeneribus similibusque recedit, cæteroquin structura convenit. Planta caulibus rubris, foliis aureo-nitentibus, ramis nonnullis apice corpuscula articulata in foliorum axillis ferentibus. *Folia* non marginata. A *Clastobryo Indico* (Dozy et Molk.) longe diversus.

vii. *Isothecium*, Schimp., ex parte.

102. S. ORIENTALIS (*Mitten*). Dioicus, ramis erectis inferne nudis superne dendroideis fasciculato-ramosis, foliis patentibus remotiusculis distichaceis ovalibus acutis superne serrulatis nervis binis brevibus, cellulis elongatis angustis, perichætialibus erectis lanceolatis serrulatis, theca in pedunculo elongato brevi-ovali horizontali, peristomio normali?

Hypnum confertum, *Griff.*

Hab. In Assam superiore, *Griffith*!

Species parva, ramis uncialibus sparse foliosis. *Pedunculus* uncialis. Primo adspectu speciebus parvis *Thamnii* similior, sed structura

foliorum omnino hujus gregis, et *Isothecii* Indici exemplum primum constituens.

viii. *Hylocomium*, Schimp.

* *Folia* longe acuminata.

103. S. SURCULARIS (*Mitten*). Dioicus? caule procumbente pinnato, ramis simplicibus vel fasciculato-pinnatis brevibus confertis attenuatis cuspidatis, foliis patentibus concavis e basi late ovali in acumen longum angustum vix serrulatum subito angustatis enerviis margine planiusculo, cellulis elongatis alaribus magnis fuscis pellucidis, perichætialibus lanceolatis, theca in pedunculo longissimo gracili ovali inclinata, peristomio dentibus brevibus luteis processibus æquilongis ciliis unicis latiusculis brevioribus interpositis.

Hypnum extenuatum, var., *Wils. in Sched.*

Hab. In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 1031).

Habitu *S. extenuati*, sed compactior et rigidior, ramis fere omnibus attenuato-cuspidatis, foliis margine planiusculis. *Theca* in pedunculo sub-biunciali parva.

104. S. lanytrichus. (Hypnum, *Dozy et Molk.*—H. barbatum, *Wils. in Sched.*)

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 975, 1100).

105. S. PENICILLATUS (*Mitten*). Dioicus, caule rubro cæspitoso ramis dendroideis pinnatis curvatis fasciculatis prolifero, foliis patentibus orbiculari-ovalibus obtusis apiculo angusto piliformi flexuoso elongato terminatis inflexura marginum concavis enerviis apice apiculum versus serrulatis, cellulis angustis elongatis alaribus magnis utrinque tribus oblongis luteis, perichætialibus parvis vaginam non tegentibus ovatis acuminatis serrulatis, theca in pedunculo elongato rubro ovali-cylindrica inclinata horizontalive, operculo rostrato longitudine thecam dimidiam æquante, peristomio interno processibus solidis dentium longitudine ciliis binis brevioribus interpositis in membrana ad tertiam partem dentium longitudinis exserta.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 778, 1035, 1040, 1074).

Species pulchra, foliis pallidis hic illic aureo-fulvo tinctis, ramis fasciculatis curvatis.

106. S. PSILURUS (*Mitten*). Caule repente, ramis dendroideis bipinnatis ramulis ad unum latus spectantibus curvatis, foliis rameis erecto-patentibus ovatis tenui-acuminatis brevissime binervatis marginibus superne minute remote serrulatis, ramulinis elliptico-ovatis marginibus planis fortiter serratis, nervo unico ad medium percurrente, cellulis in foliis rameis angustis lævibus in ramulinis dorso ad folii apicem

papillis grossis sparsis dentiformibus alaribus vix conspicuis pellucidis.

Leptohymenium tenue, var., *Wils. in Sched.*

Hab. In Nepal orient. reg. temp., *J. D. Hooker* (No. 754).

Habitu *L. tenuis,* sed gracilior, foliis patentibus, nunquam patulo-recurvis tortisve, etiam diversiformibus.

107. S. PILOSULUS (*Mitten*). Dioicus, habitu *S. tenuis,* gracillimus, foliis orbiculari-ovatis concavis sæpe paululum asymmetricis in acumen piliforme attenuatis nervis binis brevibus margine superne serrulato, cellulis angustissimis elongatis alaribus inconspicuis, perichætialibus patentibus lanceolatis serrulatis, theca in pedunculo elongato ovali horizontali pendulave, operculo conico rostrato.

Hab. In Assam superiore, *Griffith.* In mont. Khasian., *J. D. Hooker et T. Thomson* (fragmentum).

Statura *S. glaucocarpi,* habitu autem, ramis dendroideo-fasciculatis, *S. tenuis.*

108. S. papillatus. (Hypnum, *Harvey, Hook. Icon. Plant. Rar.* t. 23. f. 8.)

Hab. In India orient., *Wallich!* Etiam in Borneo insula, *Motley!*

Pedunculus longissimus. *Theca* ovalis, curvata, horizontalis, operculo conico, peristomio interno dentium longitudine ciliis singulis æquilongis interpositis in membrana ad dentium medium fere exserta. *Folia* perichætialia interna longissima, attenuata, flexuosa.

** *Folia* brevi acuminata.

109. S. HIMALAYANUS (*Mitten*). *S. umbrato* similis, foliis latis subtriangulari-cordatis acutis profunde triplicatis nervo ut plurimum unico tenui ultra medium evanido margine argute serrata, cellulis elongatis angustis lævibus basi fuscis.

Hypnum umbratum, var., *Wils. in Sched.*

Hab. In Nepal, *Wallich!* In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 1103).

S. umbrato statura similis, habitu autem, caule strictiore, ramis densioribus sensim longitudine decrescentibus et frondem filicinam formantibus et foliis brevioribus margine non recurvo, recedens.

110. S. macrocarpus. (Hypnum, *Hornsch.*—H. discriminatum, *Mont.* —H. paraphysale, *C. Müller, Bot. Zeit.* 1854, p. 572.)

Hab. In Himalayæ reg. temp., Nepal, *Wallich!* Sikkim, *J. D. Hooker!* (No. 949, 951, 952, 967, 1057, 1059, 1168, 1169). Kumaon, *Strachey et Winterbottom!* In Assam, *Griffith!* In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson!* (No. 1033 *e,* 1053, 1054, 1058, 1089, 1093, 1094, 1095). In mont. Nilghiri, *Perrottet! Gardner! Gough! Schmid! G. Thomson* (No. 1176). In Ceylon, *Gardner!*

Species polymorpha, magnitudine valde varians. *Theca* nunc fere erecta, nunc pendula.

111. S. pseudostriatus. (Hypnum, *C. Müller, Bot. Zeit.* 1856, p. 458.)
Hab. In Nepal, *Herb. Kunze.*
E descriptione, forma *S. macrocarpi* videtur.

112. S. tenuis. (Neckera, *Hook.*—Leptohymenium, *Schw.*)
Hab. In Himalayæ reg. temp., Nepal, *Buchanan*! *Wallich*! *J. D. Hooker* (No. 958); Sikkim, *J. D. Hooker* (No. 908, 947, 948, 950, 953, 960, 974). In mont. Khasian. reg. temp. *J. D. Hooker et T. Thomson*! (No. 946, 959, 961).

113. S. Hookeri (*Mitten*). Dioicus, caule procumbente, ramis frondiformibus pinnatis, foliis patenti-recurvis latissime ovatis acutis marginibus ad medium reflexis integerrimis deinde ad apicem incurvum aculeato-dentatis nervis binis brevibus, cellulis angustis lævibus alaribus externis majoribus hyalinis decurrentibus internis circiter binis rubris, perichætialibus erectis e basi latiuscula lanceolatis sensim tenuiter undulato-attenuatis subplicatis integerrimis, theca in pedunculo longiusculo recto rubro erecta subglobosa lævi, operculo conico-acuto, peristomio dentibus fuscis interno pallido processibus latiusculis solidis ciliis brevibus interpositis in membrana ad tertiam partem dentium longitudinis exserta.
Pilotrichum venustum, *Wils. in Sched.*
Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 819, 820).
S. venusto (*Hypnum*, Reinw. et Nees; *Hookeria leptopoma*, Schw. t. 393) similis, sed omnibus partibus major, pulcher, fulvo-nitidus. *Theca* magna.

114. S. micans. (Hypnum, *Wils.*)
Hab. In Himalayæ orient. reg. temp., Sikkim, in Monte Tonglo, *J. D. Hooker*!
Specimina Indica Hibernicis paululum saturatius fusca, cæterum omnibus partibus conveniunt.

115. S. serrula (*Mitten*). Caule brevi ramoso laxe cæspitoso, foliis caulinis patentibus ovatis acuminatis caviusculis brevissime binerviis nitidis marginibus e basi ad apicem pulchre argute serratis, rameis paululum angustioribus enerviis eodem modo serratis, cellulis elongatis pellucidis nitidis.
Hab. In Himalaya temperata, Sikkim, in cacumine montis Tonglo, ad radices filicum, fragmenta, *J. D. Hooker*; et Kumaon, ad Dwali, alt. 8500 ped., *Strachey et Winterbottom*!
Species pulchella, quametsi sterilis, foliis margine ubique argute serrato, *Fabronias* in memoriam redigens, cum nulla alia Indica commutanda. Statura *S. subsimplicis* (*Hypnum*, auct.); habitus potius *S. macrocarpi*. *Color* pallide viridis micans, ætate pallide fuscus.

116. S. lychnites (*Mitten*). Dioicus, caule laxe intertexto cæspitoso inordinatim pinnato, foliis patulis heteromallis e basi ovata sensim in

acumen longum lanceolatum flexuosum tortile attenuatis margine serrulatis nervis binis brevissimis, cellulis angustis elongatis alaribus vix conspicuis, perichætialibus conformibus subintegerrimis, theca in pedunculo longiusculo ovali subcernua, operculo conico-acuto, peristomio normali.

Hab. In mont. Nilghiri, *Gough*! In mont. Khasian., *J. D. Hooker et T. Thomson*, fragmenta. In Ceylon, *Gardner* (No. 1025, 1052, 1119).

Hypno mollusco statura colore et adspectu similis, sed foliis vix unquam secundis basi minus dilatatis argutius serrulatis, cellulis ubique homomorphis recedens.

117. S. polymorphus. (Hypnum, *Hook. et Tayl.*)

Hab. In Himalayæ boreali-occident. reg. temp., Simla, *T. Thomson*! (No. 1030).

118. S. LACERULUS (*Mitten*). Monoicus, pusillus, flavus, caule gracillimo vage ramoso, foliis laxis squarrosis e basi rotundato-ovato in acumen longe lanceolatum sensim angustatis nervis binis brevissimis marginibus ubique serrulatis folii medium versus incurvis, cellulis elongatis alaribus nullis, perichætiis magnis foliis erectis internis elongatis latiusculis superne in lacinias angustas laceris, pedunculo elongato.

Hab. In India orient., *Wallich*!

S. Sommerfeltii (*Hypnum*, Myrin), formis minoribus similis, sed foliis serrulatis et perichætialibus laceris.

119. S. glaucocarpus. (Hypnum, *Reinwdt.*, *Schw.* t. 228.—H. retroflexum, *Harvey*, *Hook. Icon. Plant. Rar.* t. 23. f. 6.)

Hab. In India orient., *Wallich*! In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 1085).

6. CHÆTOMITRIUM, *Dozy et Molk. Musc. Archip. Ind.* p. 117.

1. C. VOLUTUM (*Mitten*). Caule repente, ramis confertis curvatis compressiusculis, foliis rameis patentibus ambitu ellipticis concavis apicem versus contractis deinde in apicem planiusculum subovatum margine flexo recurvove productis brevissime binervatis marginibus serrulatis dorso papillosis, cellulis elongatis angustis subobscuris alaribus paucissimis hyalinis, perichætialibus brevibus in apiculum longiorem angustiorem attenuatis, theca in pedunculo breviusculo lævi ovali inclinata.

Hab. In Ceylon, ramulos arborum circumvolvens, *Thwaites*!

C. elongato simillimum, sed pedunculo lævi et foliis paululum angustioribus.

7. PHYLLOGONIUM, *Brid.*

1. P. elegans, *Hook. et Wils.*

Hab. In Ceylon insula, *Gardner*!

Nisi foliis perichætialibus parum minus dentato-laceris, cum planta Novæ Zelandiæ omnibus partibus convenit.

8. Sauloma, *Hook. fil. et Wils. in Fl. Nov. Zeland.*

1. S. microcarpa (Pterogonium, *Harvey, Hook. Icon. Plant. Rar.* t. 24. f. 12.)

Hab. In Nepal, *Wallich*! In Ceylon, *Gardner* (No. 1032, 1033) *et Thwaites*!

9. Lepidopilum, *Brid.*

1. L. purpuratum (*Mitten*). Monoicum, caule cæspitoso procumbente parce vage ramoso, foliis compressis patentibus ovalibus asymmetricis acutis margine superne serrulatis nervis binis purpureis paulo ultra medium evanidis, cellulis oblongis crassiuscule limitatis, perichætialibus ovatis longe acuminatis serrulatis, theca in pedunculo elongato ovali horizontali collo crassiusculo ætate pendula, operculo conico brevi-rostrato, peristomio dentibus rubris interno processibus luteis brevioribus in membrana ad $\frac{1}{4}$ dentium longitudinis exserta.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 707).

L. Uticamundianum simillimum, florescentia autem monoica.

2. L. secundum (*Mitten*). Monoicum, caule procumbente ramoso, foliis compressis patentibus elongato-ovatis acutis symmetricis margine superne serrato nervis binis concoloribus ad medium evanidis, cellulis elongatis laxis longitudine latitudinem quadruplo superantibus basi parum latioribus, perichætialibus parvis lanceolatis, theca in pedunculo elongato gracili anguste ovali pendula.

Hookeria secunda, *Griff. Not.* p. 477; *Icon. Plant. Asiat.* ii. t. 99. f. 2.

Hab. In mont. Khasian., in ripis Mumbree, *Griffith*!

L. purpurato et *L. Thwaitesiano* simile, sed paululum minus et structura foliorum certe diversum.

3. L. Thwaitesianum (*Mitten*). Monoicum, caule procumbente ramoso, foliis compressis ovato-lanceolatis asymmetricis acutis margine superne serratis nervis binis concoloribus paulo ultra medium evanidis, cellulis angustissimis longitudine latitudinem octies superantibus, perichætialibus ovatis longe acuminatis, theca in pedunculo elongato inclinata subhorizontali ovali collo crassiusculo, operculo conico brevirostrato, peristomio dentibus rubris interno processibus angustis æquilongis in membrana ad $\frac{1}{5}$ dentium longitudinis exserta.

Hab. In Ceylon insula, *Thwaites*!

L. secundo simillimum, sed foliis e cellulis multo angustioribus areolatis statim distinguitur.

4. L. uticamundianum, *Mont.*

Hab. In mont. Nilghiri, *Perrottet*! *Schmid.*

10. Hookeria, *Sm.*

1. H. acutifolia, *Hook.* (H. Grevilleana, *Griff. Not.* p. 473; *Icon. Plant. Asiat.* t. 2. f. 4.)

Hab. In Nepal, *Wallich* ! In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* ! In rupibus madidis ad Surureem et Mumbree, *Griffith* !

§ XI. Neckeraceæ.

Orthotheciaceæ ex parte, Hypnaceæ ex parte, Leptodontaceæ et Neckeraceæ, *Schimp. Coroll.*

Folia compressa ut plurimum oblique inserta, apice lata, cellulis firmis, superioribus rotundatis ovoideisve, inferioribus longioribus. *Rami* pinnati, planati, frondiformes dendroideive. *Theca* erecta vel horizontalis, sæpe brevi-pedunculata et immersa. *Peristomium* Hypnacearum. *Calyptra* dimidiata, interdum parva mitriformis.

1. Stereophyllum.

Pleurocarpicum. *Folia* uninervia, cellulis rotundatis firmis. *Caulis* prostratus, vage ramosus, radicans.

1. S. Indicum (Pterygophyllum Indicum, *Belanger, Voy.* t. 9. f. 2.—Hookeria obtusifolia, *Harvey, Hook. Icon. Plant. Rar.* t. 24. f. 11.)

Hab. In Carnate, *Belanger*. Ad Silhet, *Wallich* !

2. Neckera, *Hedw.*

Omalia, *Brid.*; Leptodon, *Brid.*; Climacium, *Mohr*; Thamnium, *Schimp.*

Inter genera supra memorata, quæ pro sectionibus generis unici ægre sustinenda sunt, *Climacium* primo intuitu distinctissimum videtur, sed præter thecarum formam rectam a *Thamnio* nullo alio charactere distinguitur; nam peristomii evolutio minor ejusdem typi est ut in *Bryis*, in *Hypnis* et in *Leskeis* invenitur, et thecæ forma erecta pro distinctione generica, quum inter genera adeo naturalia ut ea separare non possumus, ut in *Dicranis*, in *Fissidentibus* et in *Leskeis*, et interdum in eadem specie, thecas rectas vel inæquales videamus, non recipienda est. *Omalia* etiam, si species Europæas tantum observaveris, satis diversa est, inter species Indicas autem in *Neckeras leiophyllas*, et hæ in *Neckeras rhystophyllas*, quæ in *N. thamnias* sensim transeunt.

* *Omalia*, Brid.

1. N. Targioniana (Omalia, *Gough, MSS.*). Dioica, caule repente, ramis brevibus subpinnatim ramosis, foliis subnitidis arcte adpressis complanatis obovatis dorsalibus ventralibusque symmetricis lateralibus paululum asymmetricis basi curvatis et basin versus margine inflexo sæpe in lobulum semiovatum dilatato subindistincte brevissime binervatis integerrimis, cellulis basi media elongatis subellipticis lateralibus superioribusque parvis rotundatis, perichætialibus erectis e basi ovata angustatis ligulatis, theca in pedunculo breviusculo ovali parva subinclinata, calyptra leniter plicata vaginulaque pilosa.

Hab. In mont. Nilghiri, *Gough* !

N. trichomanoidi magnitudine similis, sed ramis e caule repente radiculoso subuncialibus parce ramulosis. *Folia* lævia, non lucide nitentia; lateralia lobulis eorum generis Hepaticarum *Radulæ* instar.

2. N. spathulæfolia. (Hypnum, *C. Müller, Synops.* ii. p. 231.)
Hab. In India orientali (*Hb. Sentner*).

3. N. OBTUSATA (*Mitten*). *N. trichomanoidi* omnibus partibus conveniente, sed foliis apice rotundatis minutissime parceque crenulatis, apiculo nullo.
Hab. In Tibet. occid. reg. temp., *T. Thomson*!
Specimina pauca vix analysi sufficiunt; quamvis *N. trichomanoidi* adeo affinis, defectu apiculorum folii apicis facile distinguitur.

4. N. Javanica, *C. Müller*.
Hab. In Ceylon, *Gardner*!

5. N. flabellata. (Hookeria, *Smith in Trans. Linn. Soc.* ix. p. 280, t. 23. f. 2.—N. Javanica, ex parte, *Wils. in Sched.*)
Hab. In mont. Nilghiri, *McIvor*! In Ceylon, *Gardner* (No. 720) *et Thwaites*!
N. Javanicæ simillima, foliis autem ambitu magis obovatis, cellulis omnibus brevioribus apicem versus rotundatis. Perichætio, theca et peristomio haud recedere videtur.

6. N. HOOKERIANA (*Mitten*). Dioica, habitu *N. Javanicæ*, sed major, ramis elongatis ramulis inordinatis pinnatis bipinnatisque, foliis arcte complanatis divaricatis oblongo-ligulatis obtusis asymmetricis nervo paulo ultra medium evanido apice grossiuscule dentatis cæterum integerrimis margine latere inferiore basin versus anguste incurvo, cellulis inferioribus elongatis angustis alaribus nullis superioribus et apicem versus ovalibus, perichætialibus e basi brevi ovata erecta convoluta lanceolato-subulatis squarrosis apice paucidentatis nervo ultra medium evanido, theca in pedunculo æquilongo brevi ovali, operculo conico acuminato, peristomio dentibus teneris angustis processibus angustis pertusis sessilibus quam dentes triente brevioribus.
N. Javanica, ex parte, *Wils. in Sched.*.
Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 709, 712, 713, 714).—In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! (No. 723, 726).
Speciosa, subnitida, viridis, ætate fusca. *Rami* palmares altioresque, latitudine cum foliis trilineares. A *N. Javanica* statura majore, ramis minus decompositis et foliorum structura diversa.

7. N. Montagneana, *C. Müller, Bot. Zeit.* 1856, p. 436.
Hab. In mont. Nilghiri, *Perrottet*!

8. N. STRACHEYANA (*Mitten*). Foliis ovali-ligulatis curvatis apice obtusis serratis nervo sub apicem evanido, cellulis inferioribus elon-

gatis angustis superioribus apice rotundatis, perichætiis thecisque iis *N. Montagnei* similibus.

Hab. In Kumaon, *Strachey et Winterbottom.*

N. Hookerianæ simillima, sed foliis magis ovalibus, apicem minus obtusum versus angustioribus apice non exciso-dentatis sed serratis.

9. N. RECTIFOLIA (*Mitten*). Habitu *N. Javanicæ*, foliis minus arcte compressis patulo-divergentibus haud curvatis ligulatis suboblongis obtusis apiculatis apice dentatis et minute serrulatis nervo sub apice evanido, cellulis inferioribus elongatis superioribus rotundatis.

N. Javanica, ex parte, *Wils. in Sched.*

Hab. In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 722).

Folia stricta, non arcuata, nervo elongato, margine apicem versus dentibusque minute serrulatis. *N. flabellatæ* affinis; sed folia non ovalia obovatave et non adeo compressa.

10. N. dentata, *Griff. Not.* p. 463; *Icon. Plant. Asiat.* t. 88. f. 2.

Hab. In Assam, *Griffith!*

Species *N. Javanicæ* simillima videtur.

11. N. LIGULÆFOLIA (*Mitten*). *N. Javanicæ* similis, foliis caulinis ligulatis paululum arcuatis acutatis serratis nervo sub apice evanido, rameis elliptico-lanceolatis acuminatis apicem versus serratis nervo ad medium evanido, cellulis basi elongatis angustis apice ovalibus, perichætialibus longe lanceolatis integerrimis.

"N. Javanica, var.; if not that, N. spectabilis, *Wils.* may be a state of N. Javanica," *Wils. in Sched.*

Hab. In Ceylon, *Gardner* (No. 716, 717, 718).

A *N. Javanica* et *N. scalpellifolia,* foliis angustioribus nervo longiore differt. Habitu, in speciminibus efructiferis, ramulis attenuatis, foliis angustis, ab affinibus paululum recedit.

12. N. SCALPELLIFOLIA (*Mitten*). Foliis ambitu ovalibus curvatis subscalpelliformibus obtusis apice dentatis arcuatis, cellulis inferioribus elongatis apice rotundatis, nervo intensius colorato paulo ultra medium evanido, perichætialibus intimis apice dentatis.

Hab. In Ceylon, *Gardner*. Etiam e Java accepi sub nom. *N. Javanicæ.*

Species, quamvis *N. Javanicæ* simillima, foliis apicem versus angustioribus, margine superiore valde arcuato, nervo longiore, cellulis alaribus inconspicuis, et foliis perichætialibus apice dentatis diversa.

13. N. GLOSSOPHYLLA (*Mitten*). Habitu *N. flabellatæ,* foliis divergentibus appresso-complanatis obovatis apice rotundatis obtusissimis minute serrulatis nervo tenui ultra medium evanido, cellulis minutissimis oblongis.

Omalia pulchella, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 710). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 730).

A *N. flabellata*, quacum magnitudine proxime convenit, foliis linguæformibus apice dilatatis obtusissimis minutissimeque serrulatis statim dignoscitur. *Color* pallide viridis, vix nitidus.

Adest in 'Flora Nov. Zelandiæ' species longe diversa quædam, jam sub nomine *Omaliæ pulchellæ* militans, etiam a cl. Wilson imposito, qui prolis suæ sibi oblitus est.

14. N. GOUGHIANA (*Mitten*). Dioica, ramis complanatis pinnatis, foliis patentibus elongate ovatis acutis lævibus margine inferne uno latere incurvis superne remote serrulatis, nervo brevi subdisperso, cellulis basi angustis elongatis apicem versus brevioribus longitudine latitudinem triplo superantibus ellipticis, foliis ramulinis brevibus ovatis acutatis margine superne arctius serrulatis.

Hab. In mont. Nilghiri, *Gough*!

N. complanatæ formis minoribus maxime similis, sed foliis caulinis angustioribus argutius minute serrulatis, rameisque non acuminatis. Plantam masculam tantum vidi.

** *Leptodon*, Brid.

15. N. flexuosa, *Harvey, Hook. Icon. Plant. Rar.* t. 21. f. 3.

Hab. In Nepal, *Wallich*! In Himalayæ boreali-occident. reg. temp., *Strange*! *et T. Thomson*! (No. 943, 944). Ad Calcutta, *Hb. Schimper*.

16. N. Pluvini. (Pilotrichum, *Brid.* ii. p. 260.)

Hab. In India orient., *De Pluvin*.

17. N. RIGIDULA (*Mitten*). Dioica, caule repente, ramis elongatis pinnatis frondiformibus siccitate vix curvatis, foliis compressis patentibus ovatis obtusis superne subplicatis undulatisque nervo ad $\frac{3}{4}$ evanido marginibus recurvis, cellulis basi ad nervum elongatis reliquis rotundatis, perichætialibus ovatis acuminatis convolutis.

Neckera rigidula, *Wils. in Sched.*

Hab. In Himalayæ occid. reg. temp., Kashmir, *T. Thomson*! (No. 825).

N. flexuosa robustior, rigidior, ramis strictis. Habitu *Rhystophyllorum*, sed colore opaco et adspectu *Leptodontis*.

*** *Rhystophyllum*, Ehrh.

18. N. æqualifolia, *C. Müller, Bot. Zeit.* 1854, p. 567.

Hab. In mont. Nilghiri, *Foulkes*! *Schmid.*

Theca in pedunculo brevissimo, ovalis, immersa, peristomio dentibus pallidis angustis, interno processibus angustis brevioribus sessilibus.

19. N. exserta, *Hook.* (N. elegantula, *Griff. Not.* p. 464; *Icon. Plant. Asiat.* ii. t. 83. f. 5?)

Hab. In Himalayæ reg. trop., Nepal, *Wallich*! Sikkim, *J. D. Hooker*! (No. 945).

20. N. CRINITA (*Griff. Not.* p. 464; *Icon. Plant. Asiat.* ii. t. 84. f. 1). Monoica, caule repente, ramis vage subpinnatim ramosis, foliis compressis patenti-divergentibus ovali-ligulatis obtusissimis pluries trans-

verse undulatis margine inferiore incurvis integerrimis nervo infra medium evanido, cellulis basi elongatis superne minutis ovalibus rotundisque, perichætialibus externis patulis ovatis longiuscule acuminatis obtusis ad thecæ dimidium attingentibus internis erectis angustis setiformibus apice erosis ad apicem operculi productis, theca in pedunculo brevissimo ovali, operculo conico rostrato, calyptra parva pilosa.

Hab. In Ceylon, *Thwaites*! In Assam, *Griffith*!

N. exsertæ similis, perichætiis autem *N. undulatæ*, sed minoribus vix folia caulina superantibus.

21. N. ACUTATA (*Mitten*). Habitu *N. exsertæ*, foliis laxe compressis e basi ovata angustatis ligulatis asymmetricis parum longitudinaliter undulatis nervo sub apicem acutatum evanido marginibus fere ubique minute crenulato-serrulatis, cellulis basi elongatis angustis cito in minutas rotundas diametro $\frac{1}{4000}$ unciæ metientes transeuntibus.

N. fimbriata, var.? *Wils. in Sched.*

Hab. In mont. Khasian. reg. temp. *J. D. Hooker et T. Thomson*! (No. 912.)

22. N. RUGULOSA (*Mitten*). Habitu *N. undulatæ*, foliis laxe compressis patentibus e basi parum dilatata ovata sensim ligulatis obtusis apiculo brevi parce rugoso-undulatis sublævibus nervo sub apicem evanido margine inferiore uno latere incurvo ubique minutissime crenulato-serrulato, cellulis basi elongatis angustis in medio ovalibus apice rotundis et diametro $\frac{1}{3000}$ unciæ metientibus.

Hab. In Ceylon, *Thwaites*!

N. acutata major, foliis longioribus, cellulis majoribus; statura *N. undulatæ*, sed foliis non regulariter compressis ætate porphyriis.

23. N. HIMALAYANA (*Mitten*). Ramis frondiformi-pinnatis bipinnatisque, foliis compressis ovato-elongatis asymmetricis transverse parce undulatis apice obtusis brevi-acuminatis, nervo sub apice evanido, marginibus incurvis integerrimis apice tantum parcissime minute serrulatis, cellulis basi angustis elongatis medio elongatis longitudine latitudinem quadruplo superantibus apice subellipticis quam eæ medii dimidio brevioribus et diametro $\frac{1}{3000}$ unciæ metientibus.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*!

Habitu, colore staturaque *N. undulatæ*, sed foliis minus undulatis, apice minus obtusatis, marginibus incurvis, et cellulis omnibus longioribus.

24. N. flaccida, *C. Müller*.

Hab. In Ceylon insula, *Gardner*!

25. N. PARISHIANA (*Mitten*). *N. undulatæ* simillima, foliis paululum laxioribus compressis divergentibus ovatis longe ligulatis curvatis asymmetricis pluries transverse undulatis apice obtusis rotundatis mucronulo brevissimo, nervo sub apice evanido, marginibus ubique minutissime crenulato-serrulatis inferiore ad basin late auriculari modo

incurvo pulchre pluries undulato-plicato, cellulis basi angustis elongatis mediis apicalibusque ovalibus latitudine $\frac{1}{5000}$ unciæ metientibus.

Hab. Ad Moulmein, in sylvis humidis, *Rev. D. Parish*!

26. N. fimbriata, *Harvey, Hook. Icon. Plant. Rar.* t. 21. f. 4.

Hab. In mont. Khasian. reg. subtrop., *J. D. Hooker et T. Thomson* (No. 912, 988). In Himalayæ reg. trop., Nepal, *Wallich*! Sikkim, *J. D. Hooker*!

27. N. UROCLADA (*Mitten*). Dioica, cæspitosa, ramis brevibus dichotomis subpinnatisque in ramulos elongatos caudiformes diversa crassitudine productis, foliis subcompressis in ramulis elongatis subtereti-imbricatis patentibus ovatis ligulatis obtusis parce undulatis vel lævibus nervo crassiusculo sub apice evanido marginibus basi incurvis apice subcrenulatis, cellulis basi elongatis angustis apice ovoideis firmis, perichætialibus brevibus ovatis acuminatis apice obtusis, theca ovali erecta in pedunculo triplo longiore.

Hab. In Rangoon, *McClelland*!

Habitu cæspitoso, ramis variis conferte ramulosis a congeneribus recedit; habitu foliorum vix compressorum, *N. fimbriatæ* subsimilis, sed forma et cellulis diversa.

**** *Climacium*, Mohr.

28. N. FRUTICOSA (*Mitten*). Dioica, caule repente, ramis frondiformibus inferne nudiusculis stipitatis bipinnatis, foliis rameis patentibus ovali-oblongis gibbosis planiusculis apice acuto parce serratis nervo ad $\frac{3}{4}$ evanido, cellulis elongatis apice folii tantum rotundatis, ramulinis oblongis obtusioribus magis serratis, perichætialibus parvis vaginam vix tegentibus e basi ovata erecta acuminatis patulis, theca in pedunculo elongato rubro gracili-ovali erecta, peristomio dentibus subalbidis processibus tenuiter elongatis perforatis e membrana brevi ortis.

N. longirostris, var.? *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 711, 719).

N. (*Porotricho*) *longirostri* similis, sed rigidior, foliis minus complanato-appressis, ramulinis apice latioribus obtusiusculis et cellulis ad folii apicem subrotundatis diversa.

29. N. macrocarpa, *Brid., Schw.* t. 267.

Hab. In Nepal, *Wallich*.

30. N. subserrata, *Hook.* (N. breviseta, ex parte, *Wils. in Sched.*: "name proposed to replace *N. subserrata*, it not being a *Neckera* of any age or system," *Wils. in Sched.*)

Hab. In Himalayæ reg. temp., Simla, *T. Thomson* (No. 1012); Sikkim, *J. D. Hooker*! (No. 1013).

Species monoica, habitu *N. Alleghaniensis* (*Hypnum*, C. Müller, Synops. ii. p. 502).

31. N. ARCUANS (*Mitten*). Monoica, caule repente, ramis dendroideis stipitatis proliferis pinnatis uno latere curvatis, foliis patentibus elliptico-ovatis elongatis apice dentatis nervo crassiusculo sub apice evanido dorso dentato, cellulis oblongis pellucidis, perichætialibus parvis erectis ovato-lanceolatis, theca in pedunculo brevi crassiusculo erecta brevi-ovata, collo distincto, peristomio luteo.

N. breviseta, ex parte, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 1013 *b*). In mont. Nilghiri, *Gardner*!

N. *Alleghaniensi* simillima, sed foliis basi angustioribus, nervo crassiore dorso dentato diversa. A *N. subserrata* cellulis foliorum duplo majoribus et ambitu foliorum ipsa magis angustata recedit.

32. N. crenulata, *Harvey, Hook. Icon. Plant. Rar.* t. 21. f. 6. (N. spectabilis, *Griff. Not.* p. 463 ; *Icon. Plant. Asiat.* ii. t. 88. f. 3.)

Hab. In Himalaya temperata, Nepal, *Wallich*! In Kumaon, *Strachey et Winterbottom*! In mont. Khasian., *Griffith*! *J. D. Hooker et T. Thomson*!

33. N. alopecuroides. (Hypnum, *Hook. Icon. Plant. Rar.* t. 24. f. 5.—N. efructifera, *Griff. Icon. Plant. Asiat.* ii. t. 87. f. 3, forsan hujus loci est.)

Hab. In Nepal, *Wallich*!

34. N. Schmidii. (Hypnum, *C. Müller, Bot. Zeit.* 1854, p. 574.)

Hab. In mont. Nilghiri, *Schmid.*

35. N. PARVULA (*Mitten*). Habitu *N. Alopecuri*, gracilis, humilis, pinnata bipinnatave, foliis laxe compressis patentibus late ovatis apice acutis acutatisve asymmetricis haud curvatis apicem versus serrulatis nervo crassiusculo lutescente sub apice evanido, cellulis omnibus minutis distinctis rotundis perichætialibus apicibus serrulatis.

Hab. In mont. Nilghiri, *M'Ivor*!

Species parva. *Caulis* uncialis—sesquiuncialis. *Folia* parva, pallide viridia, opaca.

§ XII. LEUCODONTACEÆ.

Leucodontaceæ et Hedwigiaceæ, *Schimp. Coroll.*

1. HEDWIGIA, *Ehrh.*

1. H. Indica. (Anœctangium, *Mont. in Sched.*—Neckera macropelma, *C. Müller, Synops.* ii. p. 104.)

Hab. In mont. Nilghiri, *Perrottet*! *Schmid*! *M'Ivor*!

2. H. ATTENUATA (*Mitten*). Dioica? ramis attenuatis subpinnatis, foliis laxe patentibus ovali-ellipticis longe acuminatis, in ramulorum

apicibus piliformibus plicis circiter quinis obtusis exaratis, marginibus late planatis recurvisque, cellulis in folii medio ad basin flavis elongatis angustis ad angulos parvis rotundis superioribus subrotundis inter se subdistantibus texturam fuscam formantibus, perichætialibus longioribus angustioribus lanceolatis apicibus latiusculis acutis erectis, theca in pedunculo elongato aurantiaco ovali.

Hab. In Himalayæ occident. reg. temp., Kumaon, alt. 10,500 ped., *Strachey et Winterbottom*!

Habitu *H. secundæ*, sed foliis laxius dispositis in ramulis subpiliferis, et cellulis majoribus distincta.

3. H. imberbis, *Spruce*. (Anœctangium, *Hook. et Tayl. Musc. Brit.* p. 14, t. 6.)

Hab. In Ceylon, *Gardner* (No. 798).

4. H. ciliata, *Ehrh.*

Hab. In Nepal, *Wallich*!

2. Leucodon, *Schw.*

1. L. secundus. (Sclerodontium, *Harvey, Hook. Icon. Plant. Rar.* t. 21. f. 1.—S. strictum, *ejusd. l. c.* t. 21. f. 2.)

Hab. In Himalayæ reg. temp., Nepal, *Wallich*! Sikkim, *J. D. Hooker* (No. 794); Kumaon, *T. Thomson* (No. 789, 790), *Royle*! et in Simla, *Jacquemont*! *T. Thomson*! (No. 788, 793, 795). In Tibet. occid. reg. temp., *T. Thomson* (No. 792).

Variat foliorum directione, ut in *L. sciuroide*.

2. L. sciuroides, *Schw.*

Hab. In Himalayæ occidentalis reg. temp., Kashmir, *T. Thomson* (No. 787 *c*), sterilis.

3. L. Thomsoni (*Mitten*). Monoicus, caule repente, ramis parce ramosis curvatis, foliis patentibus ovatis acuminatis concavis nervo vix ad medium percurrente marginibus late planatis, cellulis inferne minutis rotundatis superne elongatis, perichætiis inconspicuis foliis e basi convolutacea subulatis, theca emergente ovali, operculo conico brevi-curvirostrato, calyptra parva pilosa, peristomio dentibus subulatis rubris interno processibus angustis quam dentes dimidio brevioribus.

Lasia Indica, *Wils. in Sched.*

Hab. In Himalayæ boreali-occident. reg. temp., Simla, *T. Thomson* (No. 791), in cæspite *L. secundi*.

Habitu staturaque *L. sciuroidis*, sed mollior. *Perichætia* brevia, vix conspicua. *Theca* parva. A *Lasia trichomitria* et *L. Californica*, quantum e speciminibus paucis elucet, ramis simplicibus non pinnatis et habitu fere exacto *L. sciuroidis*, discrepans.

3. Cryphæa, *Brid.*

* *Eucryphæa.*

1. C. sphærocarpa. (Neckera, *Hook. Trans. of Linn. Soc.* ix. p. 312, t. 27. f. 1.)

Hab. In Himalayæ reg. temp. Nepal, *Buchanan*! Sikkim, *J. D. Hooker* (No. 818).

2. C. Indica. (Pterogonium, *Mont. Syllog.* p. 21.)

Hab. In mont. Nilghiri, *Perrottet*! *Gough*! *Foulkes*! *et Schmid.* In Himalayæ boreali-occident. reg. temp., Simla, *T. Thomson*! fragmentum.

** *Acrocryphæa*, Hook. et Wils.

3. C. concavifolia. (Schœnobryum julaceum, *Dozy et Molk. Musc. Archip. Ind.* t. 60.—Orthotrichum concavifolium, *Griff. Not.* p. 400; *Icon. Plant. Asiat.* ii. t. 76. f. 3.)

Hab. In Nepal, *Wallich*!

A *C. julacea* (*Grimmia,* Hornsch.), foliis perichætialibus interioribus minus subulato-aristatis, caulinis marginibus planis recurvulisve, et a *C. Gardneri* (species altera hucusque non descripta, a beato Gardner in Brasilia lecta et sub No. 75 evulgata, quamvis *C. julaceæ* valde similis, marginibus foliorum revolutis distinguenda) foliis marginibus planis vel paululum recurvis, recedit.

*** *Dendropogon*, Schimp.

4. C. ferruginea (*Mitten*). Ramis pendulis laxe pinnatim ramosis, foliis patentibus e basi ovali subulatis lanceolatis acutis, nervo fusco sub apice evanido, margine paululum recurvo, cellulis basi ad nervum elongatis angustis luteis ad angulos minutis transverse longiuscule ovoideis superioribus ovoideis omnibus minutis distinctis inter se subremotis.

Hab. In mont. Nilghiri, *Gough*!

A *C. rufescente,* habitu similis, foliis diversiformibus, et, structura quamvis similis, notis descriptis distincta.

4. Cleistostoma, *Brid.*

1. C. ambigua. (Pterogonium, *Hook. Trans. of Linn. Soc. Lond.* ix. p. 310, t. 26. f. 4.)

Hab. In Himalayæ reg. temp., Nepal, *Buchanan*! *Wallich*! Sikkim, *J. D. Hooker*? (No. 822, 823). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 821, 824).

§ XIII. Leskeaceæ.

Pseudo-Leskeaceæ et Leskeaceæ, *Schimp. Coroll.*

1. Anomodon, *Hook.*

1. A. viticulosus, *Hook.* (A. obtusifolius, var.? *Wils. in Sched.*)

Hab. In Himalayæ reg. temp., Nepal, *Wallich*! Simla, *T. Thomson*! (No. 1112, 1116).

2. A. integerrimus (*Mitten*). Ramis compressis subpinnatis, foliis e basi ovata ligulatis obtusis marginibus integerrimis nervo sub apice evanido, cellulis minute papillosis diametro $\frac{1}{2000}$ unciæ metientibus.

A. obtusifolius, var., *Wils. in Sched.*

Hab. In Himalayæ reg. temp., Nepal, *Wallich*! Simla, *T. Thomson* (No. 1172),

A. viticuloso minor, foliis compressis brevioribus latioribusque et cellulis majoribus. Ab *A. obtusifolio* foliis integerrimis discrepans.

3. A. planatus (*Mitten*). Ramis compressis vage subpinnatis, foliis bifarie dispositis ovato-ligulatis obtusis asymmetricis marginibus non erosis nervo sub apice evanido, cellulis diametro $\frac{1}{3000}$ unciæ metientibus.

" *A. obtusifolius*, small barren state," *Wils. in Sched.*

Hab. In Himalayæ reg. temp., Simla, *T. Thomson* (No. 1126). Sikkim, in cacumine montis Tonglo, alt. 10,000 ped., ad radices filicum, *J. D. Hooker*!

A. obtusifolio A. integerrimoque similis, foliis tamen integerrimis a priore diversus; a secundo, foliis nervo uno lateri proximo asymmetricis, et magnitudine cellularum, distinctus.

4. A. tristis, *Cesati.* (A. fragilis, *Wils. in Lond. Journ. of Botany*, 1848, t. 10.—Leskea tristis, *Cesati in De Notaris, Syllab. Musc.* p. 67.)

Hab. In Himalayæ boreali-occident. (Kumaon), et Tibet. occid. reg. temp., *T. Thomson* (No. 1110). In Nepal, *Wallich*! Etiam in imperio Sinensi, *Alexander*!

Inter specimina Indica et Europæa Cesatiana discrimen nullum invenio.

5. A. acutifolius (*Mitten*). Ramis dendroideo-ramulosis proliferis, ramulis secundis decurvatis attenuatis, foliis ovatis acutis apicem versus serratis nervo ad $\frac{3}{4}$ evanido, cellulis pellucidis, perichætialibus vaginantibus e basi late oblonga subito breviter ligulatis, theca in pedunculo gracili purpureo cylindrica, operculo conico acuminato, peristomio *A. attenuati* processibus crenatis pellucidis.

A. attenuatus, var.? *Wils. in Sched.*

Hab. In Himalayæ occident. reg. temp., Kumaon, *Strachey et Winterbottom*! et *T. Thomson*! (No. 808).

Adspectu staturaque *A. attenuati*, foliis autem acutis, nullibi obscuris, et angustius serratis.

6. A. DEVOLUTUS (*Mitten*). Ramis pinnatim ramosis devolutis, foliis ovato-lanceolatis apice acuminatis acutis dentatis nervo sub summum apicem evanido.

Hab. In India montosa, fragmenta inter muscos varios, *J. D. Hooker*! *T. Thomson*! *Wallich*! *Gardner*! Etiam in Hong-Kong insula, *Bowring*!

Hujus speciei fragmenta tantum vidi. Statura coloreque plantæ, *A. viticuloso* similis. Habitus, ob ramos circinatos devolutos, singularis.

2. RHEGMATODON, *Brid.*

1. R. declinatus, *Brid.*

Hab. In Nepal, *Buchanan*!

2. R. polycarpus. (Anhymenium polycarpon, *Griff. Not.* p. 471; *Icon. Plant. Asiat.* ii. t. 97. f. 1.)

Hab. Assam, *Griffith*! In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 775).

R. declinato R. orthostegioque simillimus, foliis autem latioribus acuminatis. *Pedunculus* lævis.

3. R. orthostegius, *Mont.* (Anhymenium polysetum, *Griff. Not.* p. 472; *Icon. Plant. Asiat.* ii. t. 97. f. 2.)

Hab. In mont. Nilghiri, *Perrottet*! *Schmid.* In Assam, *Griffith.*

Specimina authentica *Anhymenii polyseti* non vidi. Sub hoc nomine in Hb. Ward. *A. polycarpum* invenio; ex icone, a *R. orthostegio* non refugit. Ubi Griffith specimen suum legit, non indicatur.

3. TRACHYPUS, *Schw.*

Folia uninervia, cellulis abbreviatis rotundatis, calyptra dimidiata.

Neckera, ex parte, *C. Müller, Synops.* ii.; Pilotrichum, *auct. nonnull.*

1. T. bicolor, *Schw.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 842, 843, 844, 845). In mont. Nilghiri, *Gardner*! In Ceylon, *Gardner* (No. 846, 847).

2. T. procumbens. (Neckera, *C. Müller, Synops.* ii. p. 80.)

Hab. Bombay, *Kegel*! In Malabar, collibus Bababoodum, *Law*!

3. T. blandus. (Neckera, *Harvey, Hook. Icon. Plant. Rar.* t. 22.)

Hab. In Himalayæ reg. temp., Kumaon, *T. Thomson*! Nepal, *Wallich*! Sikkim, *J. D. Hooker* (No. 838, 871, 873, 897, 908, 909, 924, 1073). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! (No. 782). In mont. Nilghiri, *Foulkes*! *Wight*! In Ceylon, *Gardner* (No. 911).

4. T. HARVEII (*Mitten*). Dioicus, caule repente, ramis elongatis flexuosis pendulis pinnatis lutescentibus, foliis patentibus laxis hastatis

basi cordatis auriculis latis circinatis rotundatis amplexantibus concavis plicatis superne sensim angustatis acumine semitorto nervo concolori ultra medium evanido carinatis margine serrulatis, cellulis angustissimis obscuris papillosis basi infima tantum pellucidis, perichætialibus lanceolatis apice serrulatis brevi-nervatis erectis, theca in pedunculo brevi scabro ovali erecta, operculo conico longi-curvirostrato, peristomio ciliis dentibus paululum brevioribus.

Pilotrichum attenuatum, P. fuscescens ex parte, et Neckera blanda, *Wils. in Sched.*

Hab. In Himalayæ reg. temp., Simla, *T. Thomson*! Nepal, *Wallich*! *J. D. Hooker*! Sikkim, *J. D. Hooker* (No. 840, 848, 871, 874, 905). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 895). In Ceylon, *Gardner* (No. 834).

T. blando T. fuscescentique statura intermedius et *T. nigrescenti* similis, sed foliis laxioribus auriculis latis; a *T. fuscescente*, cui torsione foliorum apiculi similis est, forma hastata non ovata, recedit.

5. T. fuscescens. (Neckera, *Hook. Musc. Exot.* t. 157; *Griff. Icon. Plant. Asiat.* ii. t. 87. f. 4.—Pilotrichum fuscescens *et* P. tortile, *Wils. in Sched.*)

Hab. In Himalayæ reg. temp., Nepal, *Wallich*! Sikkim, *J. D. Hooker* (No. 836, 877, 879, 880, 925). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! (No. 887 *b*, 888, 889, 891, 893, 904). In mont. Nilghiri, *Foulkes*! *G. Thomson* (No. 852 *c*). In Ceylon, *Gardner* (No. 835).

Crassitudine ramorum variabilis.

6. T. CUSPIDIFERUS (*Mitten*). *T. appresso* habitu staturaque similis, foliis concavis a basi auriculis rotundatis cordato-ovatis in apicem oblongo-lanceolatum subacutatum acuminatum productis nervo pallido sub apice evanido vix carinatis margine auricularum minute crenulato cæterum integerrimo sæpe pallidiore, cellulis basi pro spatio brevi pallidis iis nervo proximis elongatis angustis in auriculis ovoideis rotundatisque inter se remotioribus superioribus omnibus ovoideis minutis subobscuris luteo-viridibus lævibus.

Neckera cuspidifera, *Taylor, MSS.*!

Hab. In mont. Nilghiri, ad Ootacamund et Dodabet, *Schmid*! *Foulkes*! *Gardner* (*Hb. Greville*). In Ceylon, *Thwaites*!—Sterilis.

T. pachypodibus nonnullis australibus valde affinis, sed characteribus constantibus discrepans. A *T. cerino* (sub nomine *Neckera cerina*, Taylor, MSS., in Herb. Grevilleano asservato) forma foliorum supra medium magis contractorum et nunquam cellulis longioribus marginatorum, a *T. Hornschuchii*, alio loco descripto, cujus *Meteorium cuspidiferum* in 'Flora Novæ Zeelandiæ,' enumeratum, synonymon, est, forma etiam foliorum jam supra memorata statim dignoscitur, quamvis species primo adspectu persimillimæ sint.

7. T. ATRATUS (*Mitten*). Dioicus, caule repente, ramis pendulis flexuosis longissimis ramulis brevibus remotiusculis curvulis pinnato, foliis erecto-patentibus ramulinis julaceo imbricatis e basi cordata undulata caulem amplexante oblongis obtusis subito in cuspidem tenuem elongatam productis cymbiformi-concavis nervo tenui vix ad medium attingente marginibus superne minutissime serrulatis, cellulis elongatis lævibus alaribus nullis.

Hypnum auronitens, var., *Wils. in Sched.*

Hab. In mont. Nilghiri, *Gough*! ad Ootacamund, *Foulkes*! In Ceylon, *Gardner* (No. 815, 900).

T. Buchanani (*Leskea flexilis,* Hook. in Linn. Trans.) similis, sed species procerior videtur, ramis bipedalibus, foliis minus arcte imbricatis unicoloribus, cellulis angustioribus $\frac{1}{6000}$ unciæ latitudine et $\frac{5-7}{6000}$ longitudine metientibus, dum in *T. Buchanani* $\frac{1}{4000}$ latæ et $\frac{3-5}{4000}$ longæ inveniuntur.

8. T. Buchanani. (Neckera, *C. Müller, Synops.* ii. p. 669.—Leskea flexilis, *Hook. in Linn. Trans.* ix. p. 319, t. 28. f. 2.)

Hab. In Nepal, *Buchanan*! In Himalaya boreali-occident., *Royle*! In mont. Nilghiri, *Perrottet*!

9. T. plicæfolius. (Neckera, *C. Müller, Bot. Zeit.* 1854, p. 569.)

Hab. In mont. Nilghiri, *Schmid.*

10. T. brevirameus. (Neckera, *C. Müller, Bot. Zeit.* 1854, p. 570.)

Hab. In mont. Nilghiri, *Schmid.*

11. T. DECLINATUS (*Mitten*). Viridis, foliis ovatis basi non auriculatis sensim lanceolatis nervo sub apice evanido longitudinaliter plicatis crispatulis margine a basi ad apicem serrulatis, cellulis ad angulos pluribus parvis laxioribus superioribus angustis papillosis obscuris.

Hypnum declinatum, *Wils. in Sched.*

Hab. In Nepal, *Wallich*! In Himalayæ boreali-occident. reg. temp., *T. Thomson*! (No. 1014, 1015).

T. crispatulo valde affinis, sed ramis paululum densius pinnatis, foliis viridioribus basi non dilatatis, et cellulis ad angulos laxioribus diversus.

12. T. crispatulus. (Neckera, *Hook.*)

Hab. In Himalayæ reg. temp., Nepal, *Gardner*! *Wallich*! Sikkim, *J. D. Hooker* (No. 849, 885). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! (No. 858, 859, 860, 870, 886). In Ceylon, *Gardner* (No. 861). Forma gracilior: Nepal, *Wallich*! Sikkim, *J. D. Hooker* (No. 853, 867, 875).

13. T. AURICULATUS. *T. crispatulo* simillimus, foliis e basi auriculis angustis circinatis sensim lanceolato-angustatis longitudinaliter plicatis strictis crispatulisve, perichætio et theca *T. crispatuli*, peristomio interno ciliis quam dentes $\frac{1}{3}$ brevioribus.

Pilotrichum auriculatum, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 863, 864, 880).

A *T. crispatulo*, foliis auriculis circinatis et a basi sensim angustatis, haud a basi ovali, cellulis brevioribus, certe recedit.

4. Leskea, *Hedw.*

Pleurocarpica. *Folia* uninervia, cellulis rotundatis ut plurimum papillosis intense viridibus. *Caulis* repens, assurgens, arcuatus, iterum radicans, inde prolifer, pinnatus, sæpe foliolis vestitus.

Leskea, *Hedw. et auct.*; Leskea, Pseudoleskea et Thuidium, *Bryol. Europ.*; Thelia, *Sullivant.*

* *Homophyllæ.*

Folia caulina et ramulina fere homomorpha.

1. L. lævifolia (*Mitten*). Habitu *L. catenulatæ,* foliis ovatis acuminatis concavis margine plano recurvoque nervo crasso ad $\frac{3}{4}$ evanido, cellulis parvis rotundatis subovoidiisque distinctis lævibus.

Hab. In Himalayæ occidentalis reg. temp., Jamu, *T. Thomson*! (No. 1127, 1165).

L. catenulatæ et *L. incurvatæ* statura, colore habituque affinis, foliis tamen pellucidioribus, cellulis in folio medio ovoideis.

2. L. pellucinervis (*Mitten*). Ramis pinnatis compressis, foliis ovatis longe acuminatis planis nervo pellucido sub apice hyalino evanido, cellulis densissime papillosis obscuris.

Hab. In Himalayæ boreali-occident. reg. temp., Simla, *T. Thomson* (No. 1125, 1132, 1146).

L. rostratæ valde affinis, sed, ut videtur, diversa.

3. L. capillata (*Mitten*). Monoica, caule decumbente pinnato, foliis patentibus e basi cordata lanceolato-acuminatis longe capillaceis obtusissime bicarinatis nervo percurrente marginibus minute serrulatis basi planiusculis, cellulis pellucidis basi rotundatis apicem versus elongatis dorso minute papillosis, perichætialibus erectis lanceolatis tenuiter acuminatis integerrimis lævibus, theca in pedunculo longo gracili rubro cylindrica arcuata, operculo conico, peristomio dentibus luteis processibus angustis ciliis tribus subappendiculatis interpositis in membrana ad dentium dimidium producta.

Hypnum microphyllum, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 1073, 1123).

L. microphyllæ, Swartz, maxime affinis, foliis autem acumine angusto longissimo. Statura, *L. muricolæ* (*Hypnum,* C. Müller) similis.

4. L. obscuriuscula (*Mitten*). Monoica, caule prostrato pinnato, foliis patentibus orbiculato-ovatis concavis biplicatis brevi-acuminatis

nervo in acumen subulatum excurrente margine serrulatis, cellulis ubique papillosis rotundis ovoideisve obscuriusculis, perichætialibus erectis late lanceolatis nervo in acumen longum excurrente integerrimis, theca in pedunculo elongato ovali-cylindrica paululum curvata horizontali, operculo convexo.

Hab. In Assam superiore, *Griffith*!

L. capillatæ similis, sed foliis basi magis orbiculatis, cellulis non in parte superiore elongatis sed brevibus ovoideis rotundisve papillis obtectis.

5. L. SUBULACEA (*Mitten*). Monoica, caule repente foliolis nudo, ramis simplicibus, foliis e basi latissime ovata concava longe subulato-attenuatis falcatis recurvis nervo excurrente læviusculo marginibus serrulatis basi recurvis, cellulis distinctis papillosis, rameis patulis compressis ovatis acuminatis nervo concolori percurrente marginibus minute serrulatis cellulis subdistinctis papillosis, perichætialibus elongatis erectis lanceolatis tenuiter angustatis nervo percurrente.

Hab. In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*!

L. scopulæ simillima, sed foliis e basi brevi longe subulatis falcatis, marginibus serrulatis et dorso papillosis, diversa.

6. L. SCOPULA (*Mitten*). Monoica, caule repente pinnato foliolis brevissimis subnudo, ramis brevibus simplicibus, foliis patentibus laxis ovato-lanceolatis a basi sensim angustatis nervo luteo percurrente marginibus inferne serrulatis superne subintegerrimis, cellulis oblongis elongatisque longitudine latitudinem triplo excedente distinctis brevi-papillosis pellucidis, rameis conformibus, perichætialibus elongatis erectis tenui-membranaceis parce plicatis ovali-lanceolatis superne parce serrulatis, nervo in apiculum piliformem elongatum sensim attenuato.

Hab. In Himalaya occident., Kumaon, *Strachey et Winterbottom*.

L. capillatæ et *muricolæ* similis, sed foliis tenuius membranaceis cellulisque elongatis diversa.

7. L. consanguinea. (Pterogonium, *Mont.*)

Hab. In mont. Nilghiri, *Perrottet*!

8. L. STRATOSA (*Mitten*). Monoica, caule longe repente ramis simplicibus pinnato parce radiculoso foliolis parvis subnudo, foliis patentibus e basi orbiculari-ovata subulato-lanceolatis biplicatis nervo crassiusculo in apice evanido margine integerrimis, cellulis lævibus distinctis areolatis, rameis ovatis acuminatis sub-biplicatis integerrimis, cellulis distinctis lævibus nervo sub apice evanido, perichætialibus erectis longissimis lanceolatis tenuiter angustatis nervo percurrente, theca in pedunculo elongato cylindrica paululum curvata, peristomio interno processibus externum longitudine æquantibus in membrana ad tertiam dentium longitudinis partem exserta ciliis nullis.

Hab. In Assam superiore, ad Suddya, *Griffith*!

Statura *L. remotifoliæ* similis, sed ramis simplicibus longe diversa.

9. L. prionophylla. (Hypnum, *C. Müller, Synops.* ii. p. 481.—H. nervosum, *Hook. Icon. Plant. Rar.* t. 24. f. 3.)

Hab. In Himalayæ reg. temp., Nepal, *Wallich*! Sikkim, *J. D. Hooker* (No. 1102). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! (No. 1121). In mont. Nilghiri, *Gardner*!

Obscure viridis, ætate sublutescens. *Folia* a basi latiuscula sensim ad apicem angustata, nervo pellucido percurrente, marginibus ubique serrulatis, cellulis minutis obscuris papillosis. *Theca* peristomio interno *Leskeæ.*

10. L. RAMULIGERA (*Mitten*). Monoica, caule arcuato procumbente foliolis parce obtecto ramis pinnatim ramulosis subinordinatim ramoso, foliis patentibus hastato-ovatis sensim acuminatis sub-biplicatis nervo percurrente marginibus superne subserrulatis, cellulis subdistinctis brevissime papillosis sublævibus, rameis ovatis acutis nervo concolori margine minute serrulatis, perichætialibus elongatis erectis tenui-membranaceis ovato-lanceolatis superne parce serrulatis nervo in acumen subulatum integerrimum excurrente.

Hab. In Nepal, *Wallich*! In Kumaon, *Strachey et Winterbottom*!

Habitu inter species ramis simplicibus et pinnatis quasi intermedia, sed quoad foliorum structuram et formam omnino priori sectioni adscribenda, *L. capillatæ* et affinibus simillima. Specimina Wallichiana pedunculum juvenilem calyptra pallida longiuscula terminatum e perichætio paululum exsertum ostendunt.

11. L. Wallichii. (Hypnum, *Hook.*)

Hab. In Himalaya temperata, Nepal, *Wallich*! *J. D. Hooker*! (No. 1017). Kumaon, *Strachey et Winterbottom*!

12. L. HOOKERI (*Mitten*). Caule elongato rubro procumbente erectove simplici rarius diviso compresso foliolis brevibus vestito, ramis approximatis attenuatis patulis divaricatis recurvis undique a caule orientibus, foliis caulinis a basi brevi reniformi-hastata pluries plicata in acumen lanceolatum recurvum angustatis nervo sub apice evanido marginibus fere ad apicem recurvis subintegerrimis apice parce serrulatis, cellulis elongatis angustis lævibus basi croceis, rameis e basi orbiculari-ovata pluries plicata concava in acumen lanceolatum æquilongum attenuatis nervo carinatis margine serratis cellulis elongatis lævibus.

Hypnum scoparium, *Wils in Sched.*

Hab. In Himalayæ reg. temp., Nepal, *Wallich*, Sikkim, *J. D. Hooker* (No. 1104, 1105).

Species habitu peculiari, ramis copiosis attenuatis æquilongis, *Sphagna* simulans et *Leskearum* decus.

** *Heterophyllæ.*

Folia caulina a ramulinis diversiformia.

13. L. cymbifolia. (Hypnum, *Dozy et Molk., C. Müller, Synops.* ii. p. 485. —H. tamariscinum *et* H. prorepens, *Wils. in Sched.*

Hab. In Himalayæ totius reg. temp., Sikkim, *J. D. Hooker*! Nepal, *Wallich*! *Buchanan*! *J. D. Hooker*! Simla, *T. Thomson*! (No. 1109, 1111, 1171, 1174). Kashmir, *T. Thomson*! Kumaon, *Strachey et Winterbottom*. In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! (No. 1107, 1117, 1118); *Griffith*! In mont. Nilghiri, *Gardner*!

14. L. blepharophylla. (Hypnum, *C. Müller, Bot. Zeit.* 1854, p. 573.)
Hab. In mont. Nilghiri, *Schmid.*

15. L. pristocalyx. (Hypnum, *C. Müller, Bot. Zeit.* 1854, p. 573.)
Hab. In mont. Nilghiri, *Schmid.*

16. L. TRACHYPODA (*Mitten*). Monoica, dense cæspitosa, caule gracili dense vestito, foliis remotis e basi hastata caule angustiore acuminatis lanceolatis nervo crasso concolori in apice evanido margine recurvo integerrimo, cellulis subpellucidis, rameis patulis incurvis laxe imbricatis ovatis obtusis concavis nervo hyalino marginibus dorsoque papillis erosis obscuris, perichætialibus erectis ovalibus superne serratis nervo in acumen longum subintegerrimum sensim angustatum excurrente, theca in pedunculo elongato papillis densis scaberrimo horizontali ovali æquali, peristomio interno externum æquante ciliis singulis inter processus in membrana ad dentium dimidium protracta.

Hab. In Nepal, *Wallich*!

A speciebus similibus Indicis pedunculi scabritie facile nota. A *L. plumulosa* (*Hypnum*, Dozy et Molk.), florescentia monoica et peristomio interno diversa.

17. L. ASSIMILIS (*Mitten*). Habitu, colore et statura, *L. delicatulæ* similis, caule foliolis vestito, foliis caulinis e basi latissime ovata in apiculum apici filiformi æquilongum attenuatis margine recurvis apice serrulatis nervo sub apice evanido, cellulis ovalibus breviter papillosis distinctis, rameis ramulinisque orbiculari-ovatis valde concavis acutis serrulatis nervo sub apice evanido concolori cellulis rotundis breviter papillosis distinctis.

Hab. In Himalayæ occid. reg. temp., Kumaon, *Strachey et Winterbottom*!

L. delicatulæ (*Hypnum recognitum* auct. nonnullorum) quamvis primo visu omnino similis, oculo armato tamen certe diversa, foliis dorso papillis brevibus nec spinulosis et cellulis brevioribus.

18. L. GLAUCINA (*Mitten*). Dioica, caule (habitu *L. tamariscinæ*) parce villoso, foliis caulinis erecto-patentibus subcomplicatis late ovatis subcordatis acutis nervo ultra $\frac{3}{4}$ evanido marginibus ubique minute crenulatis, cellulis subpellucidis ubique papillosis, rameis ramulinisque

concavis obtusioribus breviter nervatis marginibus dorsoque papillis asperis, perichætialibus erectis lanceolatis loriformi-attenuatis serrulatis inferne parce lacero-ciliatis, theca in pedunculo longiusculo rubro ovali-cylindrica parum curvata suberecta, operculo conico rostrato.

Hypnum tamariscinum, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 1173 *b*). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! In Assam, *Griffith*! In Ceylon, *Maxwell*! *et Thwaites*! Etiam in Java.

L. cymbifoliæ similis, sed ramulis minus attenuatis, foliis nunquam acuminatis et colore glauco pallido ab affinibus facile distinguenda.

19. L. CONTORTULA (*Mitten*). Monoica, caule arcuato repente prolifero ramis pinnatis foliolis parvis brevissimis radiculisque vestito, foliis remotis patentibus caulis latitudine transverse semiorbicularibus planiusculis in acumen brevi-lanceolatum recurvum attenuatis nervo latiusculo in apice evanido integerrimis, cellulis distinctis, rameis ovatis ramulinis ovalibus serrulatis nervo concolori pellucidiore sub apice evanido marginibus dorsoque papillis brevissimis erosulis obscuris, perichætialibus externis patulis internis erectis ovatis serrulatis nervo crassiusculo in apiculum elongatum sublævem excurrente, theca in pedunculo elongato horizontali ovali ?, operculo longe subulato rostrato.

Hypnum contortulum, *Wils. MSS.* (*si non* H. Schiedeanum, *Wils. in Sched.*).

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 1124).

L. gratæ et *L. remotifoliæ* similis; a priore pedunculo lævi, a secundo foliis caulinis non ovatis sed basi semiorbiculatis.

20. L. tamariscella. (Hypnum, *C. Müller, Bot. Zeit.* 1854, p. 573.)

Hab. In mont. Nilghiri, *Schmid.*

21. L. MINUSCULA (*Mitten*). Monoica, caule repente foliolis subnudo, foliis patentibus semiorbiculato-hastatis caulis latitudine in acumen breve lanceolatum angustatis nervo concolori angusto in apice evanido margine minute crenulatis, cellulis rotundatis distinctis, rameis ovatis, ramulinis ovalibus acutis nervo concolori pellucido sub apice evanido, marginibus crenulatis dorso papillis scabris obscuris, perichætialibus ovatis acumine elongato latiusculo recurvo marginibus serrulatis nervo sub vel in apice evanido, theca in pedunculo longissimo horizontali arcuata ovali-cylindrica, operculo hemisphærico brevi-rostrato, peristomio dentibus dorso asperis interno processibus æquilongis ciliis brevibus nullisve in membrana ad dentium tertiam partem longitudinis exserta.

Hypnum minusculum, *Wils. in Sched.*

Hab. In mont. Khasian. reg. temp., ad ligna emortua, *J. D. Hooker et T. Thomson* (No. 1071, 1072, 1092).

L. contortulæ simillima, sed foliis crenulatis, perichætialibus apicibus latioribus recurvis, nervo non excurrente.

22. L. SPARSIFOLIA (*Mitten*). Monoica, cæspitosa, caule gracili arcuato repente foliolis dense vestito ramis pinnatis bipinnatisve ramoso, foliis parvis remotis caule angustioribus patulis hastatis acuminatis nervo sub apice evanido margine minute crenulatis, cellulis distinctis papillosis, rameis hastatis acuminatis nervo tenui pellucidiore ramulinisque ovatis acutis marginibus erosis cellulis papillosis obscuris, perichætialibus erectis ovato-subulatis serrulatis nervo percurrente, theca in pedunculo elongato rubro horizontali ovali, peristomio interno luteo processibus ciliisque binis trabeculatis interpositis dentium longitudinem æquantibus in membrana ad dentium dimidium exserta.

Hab. In Nepal, *Wallich.*

L. leptocladæ, Taylor, similis, theca tamen horizontali, peristomio perfecto, diversa.

23. L. remotifolia, *Hooker.*

Hab. In Nepal, *Wallich!* In Assam superiore, *Griffith!*

24. L. haplohymenium. (Hypnum, *Harvey, Lond. Journ. Bot.* 1840, ii. p. 21.)

Hab. In Himalayæ reg. temp., Nepal, *Wallich*; Sikkim, *J. D. Hooker!* (No. 1113, 1114, 1115). Kumaon, *Strachey et Winterbottom!*

25. L. INVESTIS (*Mitten*). Monoica, exilis, caule repente foliolis nudo, ramis pinnatis, foliis caulinis ovatis nervo indistincto, rameis ovatis incurvis obscuris nervo distincto subpellucido sub apice evanido, ramulinis oblongis obtusis, omnibus marginibus crenulatis papillosis, perichætialibus e basi subrotunda subulatis enerviis parce denticulatis, theca in pedunculo breviusculo horizontali minuta obovata macrostoma angulosa subcarnosula, peristomio normali?

Hab. Prope Moulmein, ad rupes, *Rev. D. Parish!*

Minutissima, fere byssoidea, et notis dictis ab affinibus facile distinguenda.

5. HETEROCLADIUM, *Schimper.*

Pleurocarpicum. *Folia* binervia, cellulis rotundatis oblongisve.

1. H. SUBINTEGRUM (*Mitten*). Caule repente vage pinnato, foliis laxe imbricatis late ovatis sensim in apiculum piliformem acuminatis nervis binis paulo ultra medium evanidis margine integerrimo, cellulis baseos ad angulos minoribus rotundatis obscurioribus cæteris oblongis pellucidis lævibus, foliis rameis ovato-lanceolatis apice subserrulatis.

Hab. In Himalayæ boreali-occident. reg. temp., Simla (inter *Anœctangium Thomsoni* repens), *T. Thomson!*

H. dimorpho et *H. heteroptero* intermedium; a priore ramis vagis, foliis laxius imbricatis apiculatis, a secundo ramis non compressis et foliis diversiformibus subintegerrimis diversum.

6. Callicostella, *Mitten.*

Hookeria (section v., Callicostella), *C. Müller, Synops.* ii. p. 216.

1. C. papillata. (Hookeria, *Mont.*)

Hab. In Bengalia, in collibus Garrow, *Wallich*!

A genere *Hookeria*, cujus *H. lucens* typus originalis est, habitu, necnon foliorum structura, aliena.

7. Rhacopilum, *Brid.*

1. R. orthocarpum. Dioicum? caule repente radiculoso, ramis breviusculis, foliis ovatis obtusiusculis nervo in pilum folii tertiam longitudinis partem æquante excurrente stipuliformibus ovato-lanceolatis sensim in pilum attenuatis marginibus ut in lateralibus minutissime serrulatis, cellulis conformibus oblongis distinctis, perichætialibus ovatis subulatis vagina pilosa, theca in pedunculo elongato stricto cylindracea erecta plicata, operculo conico rostrato, peristomio dentibus pallidis interno processibus dicranis ciliis brevissimis hyalinis, annulo latiusculo composito, calyptra pilosa.

R. orthocarpum, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim (No. 697); in Nepal reg. subtrop., *J. D. Hooker* (No. 695). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 694).

A congeneribus, theca erecta, facile cernendum.

2. R. Indicum (*Mitten*). Dioicum? caule prostrato laxe subpinnatim ramoso, foliis elongato-ovatis acuminatis nervo excurrente setiformi longe cuspidatis marginibus convolutaceo-incurvis ad apicem minutissime serratis subintegerrimis, cellulis parvis obscuris, foliis stipulariformibus ovato-lanceolatis longe cuspidatis, perichætialibus conformibus paraphysibus numerosis, theca in pedunculo elongato trigono gracili suberecta ætate inclinata cylindrica arcuata plicata ore obliquo, operculo conico rostrato, peristomio generis, calyptra pilis paucis appressis.

R. cristatum, *Wils. in Sched.*

Hab. In Ceylon, *Gardner* (No. 696, 698, 700).

R. cristato affine, foliis autem rigidioribus subintegerrimis convolutaceis certe recedit.

3. R. Schmidii, *C. Müller, Bot. Zeit.* 1854, p. 558.

Hab. In mont. Nilghiri, *Schmid.*

"Habitus *R. anomali.*" Etiam *R. tomentoso* et *R. spectabili*, ex cl. auctore, comparandum.

§ XIV. Mniaceæ.

Bryaceæ ex parte, Fissidentaceæ, Hookeriaceæ ex parte, *Schimp. Coroll.*
Folia cellulis superioribus hexagonis limitibus firmis cartilagineis ut plurimum cartilagineo-marginata, sæpe distichacea. *Caules* parce ramosi.

1. Fissidens, *Hedw.*

* *Adiantoideæ.*

1. F. nobilis, *Griff. Not.* p. 427; *Icon. Plant. Asiat.* ii. t. 83. f. 3. (F. filicinus, *Dozy et Molk. Bryol. Javan.* t. 7.)

Hab. In Himalayæ reg. temp., Nepal, *Wallach*! Sikkim, *J. D. Hooker* (No. 634, 635). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 621, 625, 642); in rupibus arenosis ad Mumbree, et in rupibus agri Muttack, *Griffith*! In Ceylon, *Gardner* (No. 628). Etiam in ins. Javæ et Hong-Kong.

2. F. acutifolius (*Mitten*). Caule elongato fasciculato ramoso, foliis confertis patentibus lanceolatis sensim acutis nervo fusco excurrente, lamina folii vera vix ad medium producta æquali acuta, dorsali basi contracta in caulem non decurrente, omnium laminarum marginibus incrassatis fuscis minute scabris, cellulis opacis.

F. laxifolius β, *Griff., in Herb. Ward.*

Hab. In Assam superiore, Negrogam versus, *Griffith*!

Structura foliorum *F. Japonico F. nobilique* similis, sed frondibus angustioribus. A *F. taxifolio*, foliis angustis crasse marginatis et statura altiore diversa.

3. F. anomalus, *Mont.* (F. neckeroides, *Griff. Not.* p. 426; *Icon. Plant.* Asiat. ii. t. 83. f. 1.—F. cryptotheca, *Dozy et Molk. Bryol. Javan.* t. 6.)

Hab. In mont. Nilghiri, *Perrottet*! *Gough*! In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 636). In mont. Khasian., *Griffith*! et in reg. temp., *J. D. Hooker et T. Thomson* (No. 639). In Ceylon, *Gardner*! (No. 627).

4. F. cristatus. Dioicus, foliis marginibus omnibus pallidioribus crenulato-serratis, cellulis ad folii medium obscuris, sed ad nervum utrinque serie unica cellularum elongatarum pellucidarum notatis, perichætialibus parvis, theca in pedunculo semunciali horizontali ei *F. taxifolii* simili.

F. cristatus, *Wils. l. c.* p. 294.

Hab. In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! (No. 624).

Caulis bi- triuncialis. *F. adiantoidi* quamvis valde similis, foliis paululum acutioribus et cellulis ad nervum pellucidis statim cernendus.

5. F. taxifolius, *Hedw., Griff. Icon. Plant. Asiat.* ii. t. 81. f. 2.

Hab. In Nepal, *Wallich*! In mont. Khasianis, ad Mumbree, *Griffith*!

6. F. sylvaticus, *Griff. Not.* p. 429; *Icon. Plant. Asiat.* ii. t. 81. f. 1. (F. Javanicus, *Dozy et Molk. Bryol. Javan.* t. 3.—F. falcatus, *Wils. MSS., in adnot. ad* F. pallidum, *Fl. Nov. Zeland.* ii. p. 62.)

Hab. In mont. Khasian., ad Mumbree, *Griffith*! Madras, *Wight*! In Kumaon reg. temp., *Strachey et Winterbottom*!

** *Immarginatæ.*

7. F. areolatus, *Griff. Not.* p. 428; *Icon. Plant. Asiat.* ii. t. 83. f. 2. (F. polypodioides, var., *Wils. l. c.* p. 294.)

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 620). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 622), *Griffith*! Moulmein, in monte Ava-labo, *Rev. D. Parish*!

F. polypodioidi maxime affinis, sed foliis non obtusatis et cellulis paululum majoribus recedens.

8. F. OBSCURUS (*Mitten*). Caule elongato, foliis patentibus lanceolatis, nervo sub summo apice evanido, lamina vera ad folii medium protracta apice inæquali, dorsali basi contracta, laminis omnibus integerrimis immarginatis, cellulis parvis opacis substantia molli.

Fissidens, No. 9, *Griff. Not.* p. 430.

Hab. In mont. Khasian., in rupibus rorantibus, Moflong, *Griffith*!

Caulis uncialis, cum foliis latitudine trilinearibus. Habitu *F. serrulati*, sed foliis integerrimis; *F. polypodioidi* affinior, a quo foliis non obtusatis et substantia opaciore differt.

9. F. CIRCINALIS (*Mitten*). Caule decumbente innovationibus devolutis ramoso, foliis patentibus lanceolatis apice obtuso tenui-membranaceis paululum undulatis nervo pallido tenui in mucronulum excurrente, lamina vera ad medium producta, lamina dorsali ad basin subito contracta in caulem non decurrente, laminis omnibus ob cellulas exstantes minute crenulatis, cellulis subobscuris.

Hab. In montibus supra Avam.

Luteo-fuscus, caulibus uncialibus circinato-devolutis, foliis obtusis undulatis teneris, a consimilibus remotiusculus.

10. F. grandifrons, *Brid.*

Hab. In Tibet. occid. reg. temp., *T. Thomson* (No. 629, 632, 640, 643).

11. F. INVOLUTUS. Caule elongato sub perichætio innovante, foliis patulis lanceolatis siccitate devolutis margine paululum pallidiore apicem versus crenulatis, lamina vera immarginata integerrima, lamina dorsali ad basin subito desinente rotundata in caulem non decurrente, cellulis subobscuris, nervo pallido, perichætialibus subconformibus, theca in pedunculo brevi ovali erecta.

F. involutus, *Wils. l. c.* p. 294.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 619, 641).

Luteus. *Caulis* uncialis longiorve, simpliciusculus, foliis siccitate ad caulis ventrem volutis. Habitu aspectuque *F. osmundoidi* similis.

12. F. JUNGERMANNIOIDES (*Griff. Not.* p. 425; *Icon. Plant. Asiat.* ii. t. 81. f. 4). Dioicus? caule elongato gracili siccitate deorsum curvato, foliis lanceolatis inter se remotiusculis, lamina vera inæquali, dorsali in caulem late decurrente, nervo fusco sub summum apicem evanido marginibus subcrenulatis quasi incrassatis opacioribus, cellulis minutis subobscuris, theca in pedunculo brevi terminali ovali erecta inclinatave.

Hab. In mont. Khasian., in ripis ad Mumbree, *Griffith*!

Ab affinibus, margine foliorum latiusculo opaciore obscuriore quasi incrassato, facile distinguitur.

13. F. FIRMUS (*Mitten*). Dioicus? caule elongato gracili fasciculatim ramoso rigido, foliis patentibus lanceolatis, lamina vera latiuscula supra medium protracta apice inæquali margine lato cartilagineo, lamina apicali dorsalique ad basin contracta immarginatis integerrimis nervo obscuriore, cellulis parvis rotundis distinctis areolatis, theca in pedunculo brevi terminali ovali erecta.

Hab. In Ceylon, in monte Adam's Peak, *Gardner*!

F. jungermannioidi statura facieque similis, rigidior tamen, foliis arctius imbricatis, lamina vera longiore marginata et lamina apicali dorsalique immarginatis. *Caulis* sesquiuncialis, cum foliis latitudine linearis. *Pedunculus* linearis. *Folia* superiora lutea; inferiora nigricantia.

14. F. OBSCURUS (*Mitten*). Dioicus, caule elongato gracili simplici, foliis remotiusculis lanceolatis, lamina vera ad medium protracta, apicali dorsalique basi rotundata contracta integerrimis apiceve vix crenulatis, nervo concolori tenui excurrente apiculatis, cellulis minutis subobscuris, theca in pedunculo elongato gracili horizontali.

Hab. In Ceylon, *Gardner*!

F. jungermannioidi similis, sed foliis nervo concolori et marginibus nullo vestigio incrassationis. *Caulis* sexlinearis. *Pedunculus* trilinearis.

15. F. ELONGATUS (*Mitten*). Caule elongato subsimplici subfasciculatimve ramoso, foliis densis patentibus lanceolatis acuminatis, lamina vera ad medium producta apice inæquali, apicali dorsalique ad basin abrupte immarginatis integerrimis, nervo fusco, cellulis rotundis parvis pellucidis.

F. No. 10, *Griff. Not.* p. 431.

Hab. In mont. Khasian., in arboribus prope speluncas Moosmai, *Griffith*!

Caulis bi- triuncialis, cum foliis latitudine fere bilinearis. *Color* luteo-fuscus. Statu humido vel sicco vix mutatur.

16. F. DISCOLOR (*Wils. l.c.* p. 294). Dioicus, caule elongato simplici, foliis remotis patentibus late lanceolatis obtusis vel nervo concolori in apiculum brevem excurrente, lamina vera ad medium protracta, dorsali in caulem sensim decurrente, laminis omnibus integerrimis

immarginatis, cellulis parvis parietibus crassis distinctis pellucidis, theca in pedunculo brevi gracili pyriformi erecta inclinatave.

Hab. In Ceylon, *Gardner*! (No. 631).

F. jungermannioidi subsimilis, foliis autem latioribus obtusioribus, cellulis distinctis crasse limitatis.

17. F. DIVERSIFOLIUS (*Mitten*). Dioicus? caule breviusculo gracili simplici, foliis remotiusculis ovatis acutis obtusiusculisve, nervo sub apice evanido, lamina vera ultra medium producta, dorsali basi angustata, laminis omnibus integerrimis immarginatis, cellulis pellucidis, theca in pedunculo elongato ovali erecta inclinatave.

F. debilis, *Wils. l. c.* p. 294.

Hab. In ripis humidis fluvii Soane, *J. D. Hooker* (No. 633). In Bootan, *Nuttal*!

Gracilis, *F. obtusifolio* similis, sed foliis minus obtusis et in caule fertili acutiusculis. *F. bryoides*, Griff. Icon. Plant. Asiat. ii. t. 81. f. 5 A, verisimiliter huc pertinet.

18. F. PULCHELLUS (*Mitten*). Monoicus, caule elongato ramoso, foliis patentibus late lanceolatis apice brevi-apiculatis, lamina vera æquali ad medium protracta, dorsali ad basin in caulem decurrente, omnibus laminis immarginatis minute crenulato-serrulatis, cellulis minutis subobscuris, nervo pellucidiore luteo-fusco excurrente, theca in pedunculo brevi gracili ovali-cylindrica inclinata leptodermi pallida.

Hab. In Himalayæ orient. reg. temp., Sikkim, in monte Tonglo, alt. 8000 ped. (in cæspite *F. anomali*), *J. D. Hooker*.

F. Holliano affinis, sed major et foliis lamina vera immarginata. *Caulis* uncialis, innovationibus pluribus ramosus, cum foliis latitudine circiter linearis. *Pedunculus* linearis. *Theca* flexura pedunculi inclinata tenera. *Folia* viridia, cellulis subindistinctis. Fortasse icon Griffithii *F. bryoidis* (Icon. Plant. Asiat. ii. t. 81. f. 4) huc referenda est.

19. F. CRENULATUS (*Mitten*). Monoicus, caule brevi gracili, foliis patentibus deorsum vergentibus lanceolatis sensim acutis, lamina vera hyalina cartilaginea marginata integerrima, dorsali ad basin abrupte contracta apicalique minute crenulata, nervo translucente luteo, cellulis minutis opacis, perichætio terminali vel in ramulo brevi laterali foliis subconformibus, theca in pedunculo elongato gracillimo ovali erecta arcuatione pedunculi inclinata, operculo conico longirostrato, flore masculo in ramo brevi ad pedem fœminei vel minuto in axillis foliorum caulinorum gemmiformi.

Hab. In Nepal, *Wallich*!

F. eleganti similis, foliis tamen angustioribus minus opacis obscurisque et margine minus distincte crenulatis. *Theca* minuta, ut plurimum ex eodem caule plures.

20. F. serratus, *C. Müller, Synops.* i. p. 65; ii. p. 527.

Hab. In mont. Nilghiri, *Perrottet*!

Foliis pulchre crenato serrulatis et calyptra scabra a reliquis facile notus.

21. F. PERPUSILLUS (*Wils. l. c.* p. 294). Dioicus, caule exili brevi, foliis patentibus late lanceolatis acutis, lamina vera ad medium protracta apice inæquali margine vel nullo vel interdum cartilagineo semimarginata, lamina dorsali ad basin contracta in caulem non decurrente apicalique immarginata minutissime erosis, nervo pallidiore, cellulis minutis obscuris subopacis, theca in pedunculo gracili horizontali ovali, operculo longirostrato.

Hab. In Ceylon, *Gardner*! (No. 630).

F. crenulato similis, sed foliis fere duplo latioribus in eodem caule, lamina vera irregulariter marginata.

*** *Bryoideæ.*

22. F. BIFORMIS (*Mitten*). Dioicus? caule brevi, foliis circiter sexjugis patentibus lanceolatis sensim acutis, lamina vera ad medium producta cellulis oblongis majoribus subpellucidis areolata, margine latiore, dorsali apicalique tenuimarginatis integerrimis cellulis minutis opacis, theca in pedunculo elongato ovali erecta, operculo longirostrato.

F. viridulus, *Wils, l. c.* p. 294.

Hab. In Ceylon, ad Matale, *Gardner* (No. 626).

F. exili fere minor, foliis lamina vera laxiore subpellucide, et laminis apicali dorsalique obscure opace areolatis, facile distinctus. *Caulis* vix linearis. *Pedunculus* sesquilinearis.

23. F. Ceylonensis, *Dozy et Molk. Bryol. Javan.* t. 3. (F. incurvus, var., *Wils. l. c.* p. 294.)

Hab. In Ceylon. In mont. Nilghiri, *Perrottet*! In Himalayæ reg. temp., Sikkim, *J. D. Hooker* (No. 638). Simla, *T. Thomson*!

24. F. viridulus, *Wahl.*

Hab. In Himalayæ occident. reg. temp., Kumaon, *Strachey et Winterbottom*!

25. F. bryoides, *Hedw.*

Hab. In Bengalia inferiore et in mont. Khasian. locis variis, *Griffith.*

Species vera vix est, probabiliter e pluribus parvis a Griffithio composita.

26. F. Schmidii, *C. Müller, Bot. Zeit.* 1853, p. 18.

Hab. In mont. Nilghiri, *Schmid.*

27. F. LONGISETUS (*Griff. Not.* p. 425; *Icon. Plant. Asiat.* ii. t. 81. f. 4). Caule simplici elongato, foliis lineari-scalpelliformibus integerrimis marginatis, perichætialibus similibus, seta laterali caulem subæquante, capsula inclinata cernuave oblongo-ovata, operculo e basi subhemisphærica breviter et oblique rostrato capsula breviore.—*Griff. l. c.*

Hab. In Assam superiore ripis Mumbree, *Griffith.*

Proximus *F. bryoidi,* a quo differt tantum (an satis?) setis lateralibus elongatis. A *F. adiantoide,* statura minore, foliis integerrimis, peri-

chætialibus caulinis subsimilibus operculique rostro brevi discrepat.—*Griff. l. c.*

2. Rhizogonium, *Brid.*

1. R. spiniforme, *Bruch.* (Hypnum, *Linn.*)
Hab. In Himalayæ reg. temp., Nepal, *Wallich*! Sikkim, *J. D. Hooker* (No. 646, 647, 652). In Assam, *Simons*! In Ceylon, *Gardner* (No. 648, 650, 651).

3. Mnium, *Dill.*

* *Orthomnion.* Theca erecta.

1. M. crispum (*Mitten*). Dioicum, caule sterili longe repente radiculoso fertili erecto breviusculo, foliis patentibus oblongo-ovatis nervo in mucronem excurrente marginibus incrassatis integerrimis, cellulis parvis hexagonis marginalibus in seriebus quaternis elongatis luteis, perichætialibus spathulatis, theca in pedunculo elongato ovali erecta, ore parvo, operculo conico brevi-rostrato, peristomio dentibus pallidis interno ——? calyptra nuda.
Orthomnion crispum, *Wils. l. c.* p. 368.
Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 657, 677, 678).

2. M. trichomitrium (*Mitten*). Dioicum, habitu *M. crispi*, foliis late spathulatis nervo in mucronem brevem excurrente margine angusto integerrimo, cellulis parvis hexagonis marginalibus in seriebus trinis angustis, perichætialibus angustioribus, theca in pedunculo elongato erecta ovali, peristomio ——? calyptra ramentis stramineis crispulis vestita.
Orthotrichum? bryoides, *Griff. Not.* p. 404; *Icon. Plant. Asiat.* t. 77. f. 3.—Orthomnion trichomitrium, *Wils. l. c.* p. 368.
Hab. In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! (No. 655, 656). Locis humidis ad Sururreem, *Griffith*!
A *M. crispo*, foliis basi angustatis spathulatis, cellulis paululum laxioribus et calyptra ramentacea, recedit.

** *Eumnium.*

3. M. orthorhynchum, *Brid.*
Hab. In Tibet. occid. reg. temp. et alp., *T. Thomson*! (No. 667).

4. M. serratum, *Brid.*
Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*; et in mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! (fragmenta).

5. M. lycopodioides, *Hook.*
Hab. In Himalayæ reg. temp., Nepal, *Wallich*! Sikkim, *J. D. Hooker* (No. 644, 645). In Tibet. occid. reg. temp., *T. Thomson.*

6. M. heterophyllum, *Hook.*

Hab. In Himalayæ reg. temp., Nepal, *Wallich*! Simla, *T. Thomson*! (No. 653).

7. M. rostratum, *Schw.*

Hab. In Himalayæ boreali-occident. (Jamu) et in Tibet. occid. reg. temp., *T. Thomson*! (No. 663, 664, 665, 684).

8. M. CORIACEUM (*Griff. Not.* p. 445; *Icon. Plant. Asiat.* ii. t. 91. f. 3). Synoicum, *M. rostrato* simillimum, foliis coriaceis, parietibus cellularum incrassatis, margine —— ?

Hab. In montibus Khasian. ad rupes humidas Maamloo, *Griffith*!

M. rostrato valde affine, sed foliis ob incrassationem cellularum parietum coriaceis.

9. M. DILATATUM (*Wils. l. c.* p. 368). Habitu *M. rostrati*, foliis oblongis obtusis nervo sub apicem evanido margine integerrimo, cellulis omnibus conformibus hexagonis iis *M. rostrati* 3–4-plo majoribus marginalibus vix conspicuis in serie unica elongatis angustis.

Hab. In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! (No. 670).

M. rostrato paulo major, cellulis majoribus. A *M. succulento* cellulis minoribus tenerioribus differt.

Caules repentes tantum vidi.

10. M. SUCCULENTUM (*Mitten*). Synoicum, foliis ovali-oblongis obtusis nervo percurrente marginibus dentatis, cellulis laxis marginalibus conformibus intensius coloratis, theca in pedunculo elongato horizontali pendulave oblonga, operculo conico rostrato, peristomio normali.

M. rhynchophorum, ex parte, *Wils. l. c.* p. 367.

Hab. In Nepal orient. reg. temp., *J. D. Hooker* (No. 680) *et Wallich*! In Assam, *Griffith*! In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*!

M. rostrato habitu omnino simile, sed foliis paululum majoribus, cellulis sexies majoribus succulentis, statim distinguitur. *Cellulæ* in folii medio oblongæ, prosenchymate distortæ.

11. M. rhynchophorum, *Hook.* (Bryum longirostrum, *Griff. Not.* p. 447; *Icon. Plant. Asiat.* ii. t. 91. f. 2.)

Hab. In Himalayæ reg. temp., Nepal, *Wallich*! Sikkim, *J. D. Hooker* (No. 666, 668, 669, 681). Kumaon, *Strachey et Winterbottom.* Simla, *T. Thomson*! (No. 685). In mont. Nilghiri, *Gardner*! In mont. Khasian. reg. temp., *Griffith*! *et J. D. Hooker et T. Thomson* (No. 662). In Ceylon, *Gardner* (No. 671).

12. M. undulatum, *Hedw.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker.*

13. M. cuspidatum, *Hedw.*

Hab. In Himalayæ boreali-occident. reg. temp., Simla, *T. Thomson* (No. 660).

14. M. trichomanes, *Mitten, in Hook. Journ. of Bot.* 1856, p. 231. (M. cuspidatum *et* M. rostratum, *Wils. l. c.* p. 367, 368.)

Hab. In Himalayæ boreali-occident. reg. temp., Kumaon, *Royle*! *et T. Thomson* (No. 664, 679, 683), *Strachey et Winterbottom*!

15. M. medium, *B. & S.*

Hab. In Himalayæ orient. reg. temp., Sikkim ad Kursiong, alt. 4000 ped. (fragmentum), *J. D. Hooker*!

16. M. punctatum, *Hedw.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 672, 673, 674).

4. Timmia, *Hedw.*

1. T. Austriaca, *Hedw.*

Hab. In Tibet. occid. et Himalayæ occid. reg. temp. ad Jamu, *T. Thomson*! (No. 687, 688).

5. Mniadelphus, *C. Müller.*

1. M. spathulatus, *C. Müller, Synops.* ii. pp. 24, 661.

Hab. In Ceylon insula, *Gardner* (No. 708).

2. M. obovatus. (Hookeria obovata, *Griff. Not.* p. 474; *Icon. Plant. Asiat.* ii. t. 99. f. 1.)

Hab. In mont. Khasian., ad Maamloo, *Griffith.*

E descriptione et icone Griffithii, *M. spathulato* persimillimus, florescentia autem synoica diversus.

3. M. heterophyllus. Caule procumbente, foliis patentibus compressis superioribus dorsalibus late ovalibus acutis ventralibus ovato-oblongis acutis lateralibus obovatis excavatis margine apiceque undulatis recurvis nervo sub apice evanido margine angustissime limbatis integerrimis, cellulis parvis hexagonis parietibus crassiusculis basi laxioribus elongatis oblongisve, perichætialibus parvis apiculatis.

M. heterophyllus, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 690).

M. spathulato statura et habitu similis, foliis autem flaccidioribus, lateralibus excavatis, marginibus flexuosis diversus.

4. M. humifusus. Caule procumbente, foliis compressis patentibus dorsalibus oblongis lateralibus obovatis spathulatis breviter apiculatis margine integerrimo angustissime limbatis nervo infra apicem evanido, cellulis hexagonis basi laxioribus elongatis oblongisque, perichætialibus brevibus acuminatis.

M. humifusus, *Wils. in Sched.*

Hab. In Himalayæ occident. reg. temp., Kumaon, *T. Thomson*! (No. 693).

M. heterophyllo similis, sed foliis pallide luteis ambitu magis spathulatis, cellulis fere dimidio minoribus crassius limitatis.

5. M. SUCCULENTUS (*Mitten*). Pallide albo-viridis, glaucus, caule flaccido procumbente, foliis compressis patentibus ovalibus brevi-apiculatis nervo ad $\frac{2}{3}$ percurrente margine integerrima angustissime limbatis, cellulis majusculis hexagonis parietibus angustis basi parum majoribus.

Hab. In mont. Nilghiri, *M'Ivor*!

Statura *M. paradoxi*, sed foliis ovalibus.

6. M. CEYLANICUS (*Mitten*). Caule pusillo, foliis subcompressis ovalibus obovatisve patentibus brevi-apiculatis margine integerrimo crassiuscule limbatis nervo sub apice evanido, cellulis hexagonis tenuiter limitatis basi paulum majoribus.

Hab. In Ceylon, ad "Horton Plains" (inter *Entosthodontem Busianum*), *Gardner*!

M. Griffithii statura similis, sed foliis brevioribus crasse marginatis, cellulis duplo triplove majoribus parietibus tenuioribus.

7. M. Montagnei, *C. Müller*, *Synops.* ii. p. 22.

Hab. In mont. Nilghiri, *Perrottet*, *Schmid.*

8. M. GRIFFITHII (*Mitten*). Monoicus, caule ramoso, foliis compressis patentibus ovali-spathulatis acutis margine integerrimo anguste limbatis undulatis nervo sub apice evanido, cellulis basi laxis oblongis superne minoribus hexagonis, perichætialibus parvis ovatis, theca in pedunculo elongato parva ovali horizontali.

Hookeria pulchella, *Griff. Not.* p. 476; *Icon. Plant. Asiat.* ii. t. 99. f. 3.

Hab. In Nepal, *Wallich.* In mont. Khasian., ad Kala Panee (inter *Diphyscium longifolium*, fragmenta), *J. D. Hooker*! et in rupibus sylvaticis madidis, Surureem, Mumbree et Myrung, *Griffith*!

A *M. Montagnei*, e descriptione, diversus videtur.

6. DALTONIA, *Hook.*

1. D. APICULATA (*Mitten*). Caule brevi, foliis patentibus longe ligulatis flexuosis apice in apiculum piliformem subito contractis nervo sub apice evanido carinatis margine cartilagineis integerrimis, cellulis majusculis pellucidis, perichætialibus brevissimis ovatis, theca in pedunculo elongato superne scabro erecta inclinatave ovali, operculo conico recto-rostrato, calyptra quam operculum paululum longiore.

Hab. In Nepal, *Wallich*!

A speciebus reliquis Indicis, foliis apice subito piliformi-apiculatis et cellulis laxioribus satis diversa. Statura *D. marginatæ*.

2. D. MARGINATA (*Griff. Not.* p. 465; *Icon. Plant. Asiat.* ii. 88. f. 1). Monoica, caule brevi, foliis patentibus siccitate tortis late subelliptico-lanceolatis apice acuto semitorto margine cartilagineo latiusculo limbatis nervo sub apice evanido carinatis, cellulis parvis basi oblongis superne oblongo-hexagonis, perichætialibus parvis ovatis acutis, theca in pedunculo elongato superne scabro ovali, operculo conico longe rostrato, calyptra ad thecæ dimidium attingente.

Hab. In mont. Khasian., in arboribus in pinetis Moflong, *Griffith*!

A *D. splachnoide*, foliis siccitate undulatis tortisque, diversa.

3. D. FLEXIFOLIA (*Mitten*). Monoica, caule elongato, foliis flexuoso-tortis patentibus e basi elliptica late lanceolatis apice acuminatis margine cartilagineo late limbatis nervo sub apice evanido carinatis, cellulis basi laxiusculis oblongis superne minutis oblongo-hexagonis, perichætialibus brevibus, theca in pedunculo elongato superne scabro ovali.

Hab. In Nepal, *Wallich*!

Caulis circiter 6-linearis, gracilis. *Pedunculus* bilinearis. *D. marginatæ* similis, sed foliis basi laxius areolatis margine latiore et foliis siccitate non mutatis.

4. D. SEMITORTA (*Mitten*). Caule brevi, foliis patentibus siccitate flexuosis appressis lanceolatis apice acumine semitorto curvato nervo ad $\frac{2}{3}$ folii evanido carinatis margine cartilagineo integerrimo recurvo, cellulis parvis basi elongatis superne oblongo-hexagonis, perichætialibus caulinis similibus, theca in pedunculo elongato lævi subinclinata pyriformi, operculo conico recto-rostrato, calyptra ad thecæ dimidium attingente.

Hab. In Himalayæ orient. reg. temp., Sikkim, ad montem Singalelah, in ramulis fruticum, alt. 11,000 ped., *J. D. Hooker*.

D. marginatæ statura similis, sed foliis paululum latioribus marginibus recurvis superne latioribus in apiculum longiorem acuminatis et pedunculo lævi.

5. D. SCABERULA (*Mitten*). Caule brevi, foliis patentibus siccitate tortis e basi elliptica sensim late lanceolatis planiusculis flexuosis nervo ad $\frac{2}{3}$ evanido profunde carinatis margine cartilagineo latiusculo limbatis, cellulis basi oblongis superne ovalibus subobscuris, perichætialibus brevibus, theca in pedunculo elongato scabro ovali scaberula, operculo conico rostrato, calyptra scabra.

Hab. In Ceylon, *Thwaites*!

D. ovali (Tayl.) statura accedens, foliis autem non longe acuminatis, sed apice latiusculis.

6. D. STRICTIFOLIA (*Mitten*). Caule brevi, foliis strictis patentibus anguste lanceolatis sensim acutis margine cartilagineo latiuscule limbatis nervo sub apice evanido carinatis margine recurvis, cellulis parvis longitudine latitudinem quadruplo excedente, perichætialibus brevissimis, theca in pedunculo elongato superne scabro pyriformi lævi erecta.

Hab. In Ceylon, *Gardner*! (Etiam e Java inter specimina *Hookeriæ papillatæ*.)

D. splachnoidi similis, foliis autem strictis angustis patentibus.

7. D. BREVIPEDUNCULATA (*Mitten*). Caule brevi, foliis patentibus lanceolatis attenuatis sensim piliformi-acuminatis nervo ad $\frac{3}{4}$ evanido

carinatis margine cartilagineo latiuscule limbatis, cellulis pellucidis distinctis ut plurimum suboblongo-hexagonis, perichætialibus brevissimis ovatis acutis, theca in pedunculo quam folia caulina breviore lævi ovali erecta, operculo conico rostrato, calyptra ad thecæ dimidium attingente et fimbriis incurvis eam amplectente.

Hab. Ad Bombay (inter specimina *Trachypodis procumbentis* ex *Herb. Kegeliano*) speciminula paucissima inveni.

A *D. splachnoide* foliis duplo longioribus diversa, et inter species Indicas cæteras, caule brevissimo et theca ob pedunculi brevitatem a foliis non exserta, singularis.

§ XV. Hypopterygiaceæ.

Hypopterygiaceæ, ex parte, *C. Müller, Synops.*

Folia tristicha, serie unica ventrali, *Amphigastriæformia*, minora.

1. Cyathophorum, *Brid.*

1. C. Adiantum (*Mitten*). Rhizomate repente, caulibus simplicibus apice attenuatis decurvatis, foliis lateralibus divergentibus elongato-ovalibus brevi-acuminatis asymmetricis nervo tenui infra medium evanido marginibus ubique spinuloso-serratis cellulis oblongo-hexagonis flaccidis chlorophyllosis, foliis stipuliformibus patentibus late ovatis acuminatis enerviis superne spinuloso-serratis, perichætialibus parvis lanceolatis integerrimis vaginam crassam haud tegentibus, theca in pedunculo crasso scrabro æquilongo curvato cylindrica, operculo conico brevi-rostrato, peristomio dentibus teneris pallidis interno processibus angustis elongatis sessilibus?

C. Griffithii, *Wils. in Sched.*—Neckera Adiantum, *Griff. Icon. Plant. Asiat.* ii. t. 85. f. 2?

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 699, 704). In mont. Khasian., *J. D. Hooker et T. Thomson*! (No. 703, 704 *b*, 715), *et Griffith*!

Caulis sesquiuncialis, apicem versus in foliorum axillis fila articulata rufo-fusca copiosa fovens, deinde attenuatus decurvatus. *Folia* siccitate contracta, nitoris destituta, sensim a caulis basi ad medium longitudine increscentia, deinde sensim decrescentia.

2. C. Hookerianum (*Mitten*). Habitu *C. Adianti*, ramis interdum fasciculato-divisis, foliis divergentibus elongato-ovatis apice in apiculum elongatum acuminatis asymmetricis margine tenui cartilagineo luteo limbatis apicem versus remote serrulatis nervo tenui infra medium evanido, cellulis oblongo-hexagonis flaccidis, foliis stipuliformibus brevioribus late ovalibus acumine elongato recurvo nervo ultra medium evanido, perichætio ex icone Griffithii parvo, foliis ovato-lanceolatis, theca in pedunculo æquilongo cylindrica.

C. marginatum, *Wils. in Sched.*—Neckera Hookeriana, *Griff. Icon. Plant. Asiat.* ii. t. 84. f. 2, 2 a.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 702). In mont. Khasian. reg. subtrop., *J. D. Hooker et T. Thomson* (No. 701), *et Griffith.*

C. Adianto simillimum, foliis autem tenuiter luteo limbatis non spinuloso-serratis et stipuliformibus nervatis recedens. Caulis, eodem modo ut in præcedente, fila articulata colorata in foliorum superiorum axillis fovens.

3. C. INTERMEDIUM (*Mitten*). Habitu *C. Adianti*, foliis lateralibus divergentibus ovatis acutis breviter apiculatis asymmetricis, nervo viridi ad medium evanido, margine ventrali a basi ad medium et ultra anguste tenuiter limbatis cæterum immarginatis parcissime serrulatis subintegerrimis, foliis stipuliformibus late ovatis acutis acuminatisve cauli appressis enerviis, cellulis oblongo-hexagonis pellucidis.

Hab. In Himalaya occidentali, Kumaon, *Strachey et Winterbottom*!

Species præcedentibus, ut videtur, valde similis, ab utraque diversa; a *C. Hookeriano* foliis uno latere tantum tenuiter marginatis et stipuliformibus enerviis, a *C. Adianto* foliis fere integerrimis, discrepans.

2. HYPOPTERYGIUM, *Brid.*

1. H. flavo-limbatum, *C. Müller, Synops.* ii. p. 10. (Hypnum rotulatum, *Griff. Not.* p. 478; *Icon. Plant. Asiat.* ii. t. 98. f. 1.)

Hab. In Nepal, *Wallich*! In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 689); et in rupibus calcareis prope speluncam Moosmai et in rupibus arenosis Mumbree, *Griffith.*

2. H. tenellum, *C. Müller, Bot. Zeit.* 1854, p. 557.

Hab. In mont. Nilghiri, *Schmid.*

3. H. CEYLANICUM (*Mitten*). Monoicum! tenellum, stipite brevi, ramis in frondem parvam subtriangularem dispositis flaccidis, foliis rameis late ovatis asymmetricis limbo luteo tenui apice parce dentato circumductis nervo tenui paulo ultra medium evanido, e cellulis parvis utriculo primordiali repletis limitibus mollibus areolatis, foliis stipuliformibus suborbiculatis acumine brevi, nervo tenui vix medio tenus in iis ramulorum obsoleto, perichætialibus ovato-acuminatis, theca in pedunculo rubro breviusculo lævi ovali cernua, operculo magno conico rostrato, peristomio dentibus luteis processibus angustis ciliis tribus brevibus interpositis in membrana ad dentium dimidium attingente.

H. rotulatum, *Wils. in Sched.*

Hab. In Ceylon, *Gardner* (No. 691, 692).

Ab *H. flavo-limbato*, foliis e cellulis mollioribus, forma nervoque foliorum stipuliformium et pedunculo breviore rubro recedit. Ab *H. rotulato*, foliis rameis minus acuminatis, nervo breviore, cellulis pellucidioribus, diversum.

4. H. TIBETANUM (*Mitten*). Monoicum! stipite elongato unciali, ramis in frondem parvam rotundulam dispositis flaccidis, foliis late

ovatis asymmetricis limbo tenui luteo serrato circumductis nervo ad $\frac{3}{4}$ evanido, cellulis parvis pellucidis utriculo primordiali repletis limitibus mollibus, foliis stipuliformibus orbiculatis cuspidatis serratis nervo in cuspidem percurrente, perichætialibus parvis ovatis acuminatis, theca in pedunculo breviusculo rubro superne scabro oblonga horizontali, operculo conico longirostrato, peristomio *H. rotulati.*

H. rotulatum, var., *Wils. in Sched.*

Hab. In Tibet. occid. reg. temp., *T. Thomson*! (No. 682).

H. rotulato similis, sed foliis magis serratis, cellulis pellucidioribus, seta ad capsulæ collum scabra et operculo tenui capsulam longitudine excedente diversum.

5. H. struthiopteris, *Brid.*

Hab. In Ceylon, *Gardner*! In mont. Nilghiri, *Perrottet et Schmid.*

†† Nematodonti.

Peristomium e stratis pluribus filorum, liberis vel interioribus in membranam plicatam coalitis, vel omnibus in processibus dentiformibus ad columellæ summitatem tympaniformem adhærentibus coadglutinatis.

§ I. Buxbaumiaceæ, *Schimp. Coroll.*

1. Diphyscium, *Mohr.*

1. D. longifolium (*Griff. Not.* p. 390; *Icon. Plant. Asiat.* iii. t. 96). Caulescens, foliis supremis ligulatis acutis serratis, perichætialibus retusis nervo longe excurrente, theca semiexserta.

Hab. In mont. Khasian. reg. temp., in saxis rupibusque montium ad Moosmai et Surureem, etiam in rupibus in sylvis Myrung, *Griffith*! ad Kala Panee, *J. D. Hooker et T. Thomson*! (No. 127). In Ceylon, *Gardner*!

Caulis semuncialis, inferne nudiusculus. *Folia* siccitate incurva, marginibus involutis; humida patentia. A reliquis *Diphysciis,* caule elongato, foliis serratis, facile distinguendum.

2. D. involutum (*Mitten*). Caule brevi, foliis patentibus e basi ovata erectiuscula elongata pellucido-fusca areolata angustatis et deinde dilatatis spathulato-lanceolatis apice lato obtusiusculo nervo percurrente mucronatis margine sæpe involutis levissime incrassatis integerrimis, cellulis minutis opacis interstitiis subpellucidis, perichætialibus exterioribus lanceolatis nervo in aristam longam excurrente interioribus retusis angulis acutis integris, theca peristomioque eis *D. mucronifolii* similibus.

D. longifolium, ex parte, *Griffith in Herb. Ward.*

Hab. In mont. Khasian., in loco ob confusionem non rite designando, *Griffith*!

D. mucronifolio affine, sed foliis paululum latioribus inferne contractis superne marginibus ut plurimum involutis, perichætialibus sinu et laciniis emarginationis non laceratis. A *D. longifolio*, foliis integerrimis et caule brevi, facile distinguendum. *Caulis* circiter bilinearis.

3. D. FASCICULATUM (*Mitten*). Caule elongato innovationibus fasciculatis ramoso, foliis erecto-patentibus superioribus siccitate incurvis cirrhatisque e basi ovali latiore elongata pellucide areolata longe linearibus loriformi-lanceolatis nervo excurrente mucronatis margine integerrimis levissime incrassatis, cellulis minutis opacis inter se latiuscule discretis, perichætialibus exterioribus lanceolato-subulatis interioribus linearibus apice retusis nervo excurrente.

Hab. In Ceylon, *Gardner* (*Herb. Peradeniense*, No. 120).

A congeneribus, caule elongato unciali longioreque ramoso, foliis longe loriformibus subnitentibus inferioribus siccatione vix mutatis valde diversum, et primo adspectu nonnullis speciebus robustis *Calymperidis* vel *Syrrhopodontis* similius.

§ II. POLYTRICHACEÆ, *Schimp. Coroll.*

1. ATRICHUM, *Beauv.*

1. A. SUBSERRATUM (Polytrichum undulatum, γ, subserratum, *Hook. Lond. Journ. Bot.* 1840, p. 3). Monoicum, *A. undulato* simillimum, foliis latioribus et cellulis paulum minoribus.

A. undulatum, var., *et* Catharinea flaviseta, ex parte, *Wils. in Sched.*—Polytrichum angustatum, *Griff. Not.* p. 386, *et Icon. Plant. Asiat.* ii. t. 93. f. 3, ex parte, forsan hujus loci est.

Hab. In Himalayæ orient. reg. temp. Simla, *T. Thomson*! (No. 1190, 1243), Nepal, *Wallich*! *J. D. Hooker*! Sikkim, *J. D. Hooker*! In mont. Khasian., *Griffith*! *J. D. Hooker et T. Thomson*! (No. 1207, 1219, 1222).

2. A. FLAVISETUM (*Mitten*). Monoicum, flore masculo in ramo brevi inter folia perichætialia oriente, cæteris ut in *A. subserrato*.

Catharinea flaviseta, ex parte, *Wils. in Sched.*

Hab. In Himalaya temperata, Nepal orient., *J. D. Hooker* (No. 1185, 1188, 1189). Kumaon, *Strachey et Winterbottom*! Simla, *T. Thomson*!

2. OLIGOTRICHUM, *Decand.*

1. O. semilamellatum. (Polytrichum, *Hook. fil. in Hook. Icon.* ii. t. 194. f. A.—O. Javanicum, *Dozy et Molk. Bryol. Javan.* p. 37, t. 28.—Polytrichum falcifolium, *Griff. Not.* p. 387; *Icon. Plant. Asiat.* ii. t. 93. f. 1.)

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 1216). In mont. Khasian., ad Boga Panee, *Griffith*! Himalaya, *Royle*!

3. Pogonatum, *Brid.*

1. P. Neesii, *C. Müller, Synops.* ii. p. 563; *Dozy et Molk. Bryol. Javan.* p. 40, t. 36.

Hab. In mont. Nilghiri, *Schmid.*

2. P. Himalayanum (*Mitten*). Foliis e basi oblonga lata erecta vaginante membranacea cellulis elongatis pellucidis areolata lineari-lanceolatis apice latiusculis, lamellis obtectis, margine a medio ad apicem dorsoque apicis dentatis, siccitate incurvis, perichætiis mox lateralibus foliis omnibus a caulinis dissimilibus inferioribus parvis ovatis acuminatis mediis e basi late vaginante acuminatis lanceolatis interioribus elongatis convolutis apice subulatis erectis angustis dentatis pallidis, theca in pedunculo rubro apice torto elongato-ovali erecta papillosa, operculo basi convexo in rostrum curvatum attenuato, calyptra thecam totam obtegente fulva.

Polytrichum alpinum, *Wils, in Sched.*

Hab. In Himalaya boreali-occident., *Royle*! *T. Thomson* (No. 1192). In Himalaya orient., *J. D. Hooker* (No. 1187, 1218).

P. urnigero valde simile, sed caulibus minus fastigiatim ramosis, perichætiis ut plurimum lateralibus, foliis interioribus longius exsertis, et foliis caulinis basi multo latiore longioreque. *P. alpino* etiam, latitudine folii baseos, simile, sed foliis non ad apicem sensim angustatis, et perichætio diverso. A *P. Neesii,* ex icone Bryologiæ Javanicæ, foliis dentibus remotioribus validioribus, perichætio exserto, et theca ætate non plicata, erecta, recedit. In speciminibus nonnullis fructus lateralis a caulis apice remotus perichætium vere laterale simulat.

3. P. microstomum, *Brown.* (P. urnigerum? *Griff. Not.* p. 389.)

Hab. In Himalayæ reg. temp. et alp., Nepal, *Wallich*! Sikkim, *J. D. Hooker*! (No. 1195, 1200, 1209). Kumaon, *Strachey et Winterbottom*! Mont. Nilghiri, *Perrottet*! *Gardner*! *Schmid*! *M'Ivor*! In mont. Khasian., ad Moflong, *Griffith*!

A *P. urnigero,* quocum sæpe est commutatum, foliis e basi dilatata angustatis deinde spathulato-lanceolatis latioribus et cellulis basi non subito in opacas transeuntibus certe diversum.

4. P. aloides, *Brid., Griff. Icon. Plant. Asiat.* ii. t. 92. f. 1.

Hab. In Himalayæ reg. temp., Nepal, *Wallich*! Sikkim, *J. D. Hooker* (No. 1137 *b,* 1186, 1197, 1212, 1214, 1215, 1216, 1217, 1236, 1237, 1250, 1258); Simla, *T. Thomson*! (No. 1227, 1236, 1332). In mont. Khasian. locis variis, *Griffith*; et in reg. temp., *J. D. Hooker et T. Thomson*! (No. 1220, 1228, 1234, 1245, 1246, 1247). In Ceylon, *Gardner* (No. 1206, 1223, 1266). In mont. Nilghiri, *G. Thomson*! *Schmid*! In "Garrow Hills" Bengaliæ orient., *Wallich*! In Tibet. occid. reg. alp., *T. Thomson*! (No. 1263).

5. P. hexagonum (*Mitten*). Caule brevi, foliis patentibus siccitate curvatis incurvisque appressis e basi ovata cellulis lateris oblongis

quadratisque pellucidis areolata late lanceolatis obtusiusculis lamellis dense obtectis margine leviter serratis, perichætialibus conformibus, theca in pedunculo elongato ovali scaberula inclinata sicca sub orificio plicis subindistinctis sex exarata.

Polytrichum curvifolium? *Wils. in Sched.*

Hab. In Nepal, *Wallich*! In mont. Nilghiri, *Perrottet*! In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 1244, 1248).

P. aloidis formis nonnullis minoribus valde simile; nec, nisi cellulis foliorum basi majoribus, distinctionem ullam veram inveni. *Theca* superficie eodem modo ut in *P. aloide* scaberula, sed plicis sex distinctioribus notata.

6. P. PATULUM (*Harvey, Hook. Icon. Plant. Rar.* t. 18. f. 1). Caule elongato, foliis patulis siccitate incurvis late lanceolatis basi vix latiore cellulis paucis elongatis areolata superne lamellis brevibus inter se subdistantibus obtectis margine ubique a lamellis satis remotiusculo a medio ad apicem serrato, perichætialibus basi longioribus convolutis, theca in pedunculo elongato brevi-ovali.

Hab. In Nepal, *Wallich*!

Folia e substantia tenuiore. A *P. aloide* et speciebus ei similibus distinctum, *P. gymnophyllo* affinius.

7. P. PROLIFERUM (Polytrichum, *Griff. Not.* p. 388; *Icon. Plant. Asiat.* ii. t. 93. f. 2). Caule elongato simplici sub perichætio prolifero, foliis siccitate crispatis humidis patentibus incurvisque e basi latiore sensim lanceolatis elamellosis subcomplicatis nervo dorso apicem versus dentato margine a medio ad apicem remote serrato, cellulis basi oblongis superioribus subobscuris mollibus, perichætialibus longioribus basi convolutaceis, theca in pedunculo elongato ovali-cylindrica erecta inclinatave, operculo convexo rostro brevi.

Hab. In mont. Khasian., in locis umbrosissimis infra rupes ad Surureem, *Griffith*! *et Wallich*; etiam, absque fructu, ad Churra Pungee, *Griffith*.

P. Teysmanni habitu staturaque simile, sed robustius, foliis longioribus.

8. P. FLEXICAULE (*Mitten*). Caule elato innovante flexuoso, foliis e basi oblonga parallela erecta sensim lanceolatis patentibus tota superficie lamellis brevissimis obscuris margine a medio ad apicem serratis, cellulis basi oblongis mox in quadratas rotundasque firmas fuscas transeuntibus.

Hab. In Assam, *Dna. Mack*!

Habitu staturaque *P. prolifero* simillimum, foliorum structura autem alienissimum, et etiam sterile distinctissimum. In speciminibus paucis adhuc visis caules valde sunt contorti recurvique; an hic status normalis?

9. P. SEMINUDUM (*Mitten*). Caule elongato simplici, foliis siccitate incurvis cirrhatis, humidis patulis, e basi paululum latiore erecta cellulis oblongis areolata late lanceolatis patentibus nervo lamelloso

dorso superne dentato marginibus a medio ad apicem serratis, perichætialibus angustioribus basi convolutis interioribus angustis pellucidis, theca in pedunculo elongato ovali-cylindrica ætate sexplicata.

Polytrichum seminudum, ex parte, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* ! (No. 1199).

Caulis triuncialis. *Pedunculus* uncialis. *Folia* circiter trilinearia.

10. P. NUDIUSCULUM (*Mitten*). Caule breviusculo simplici, foliis siccitate incurvis tortilibus humidis patentibus late lanceolatis superne tertiam partem latitudinis lamellosis marginibus a medio ad apicem serratis dorso ad apicem dentatis, cellulis omnibus fere conformibus minutis quadrato-rotundis, perichætialibus interioribus tribus superne paululum angustioribus, theca in pedunculo elongato flexuoso erecta subinæquali ovali-cylindrica scaberula (plicata?), operculo conico rostrato, calyptra thecam totam obtegente.

Polytrichum seminudum, ex parte, *Wils. in Sched.*

Hab. In mont. Khasian. reg. temp., *J. D. Hooker et T. Thompson* ! (No. 1249).

P. aloidi forma habituque foliorum exsiccatorum simile; *P. seminudo* tamen magis affine, sed foliis brevioribus basi non dilatatis, cellulis omnibus fere æquilongis, recedit.

11. P. GYMNOPHYLLUM (*Mitten*). Caule elongato simplici, foliis siccitate crispatis incurvisque e basi brevi erecta parum latiore cellulis paucis oblongis areolata patulis late lanceolatis cellulis subpellucidis nervo elamelloso margine a medio ad apicem serratis, perichætialibus longioribus angustioribus superne parce lamellosis dorso dentatis, theca in pedunculo elongato ovali-cylindrica inclinata.

Polytrichum gymnophyllum, ex parte, *Wils. in Sched.*

Hab. In mont. Khasian. reg. subtrop., *J. D. Hooker et T. Thomson* (No. 1208, 1224). In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* ! (No. 1241).

P. patulo persimile, foliis caulinis tamen elamellosis.

12. P. MARGINATUM (*Mitten*). Caule elongato simplici, foliis siccitate tortilibus laxis patentibus late lanceolatis nervo superne lineis paucis lamellarum subindistinctis notato margine incrassato a medio ad apicem dentibus duplicatis serratis, cellulis omnibus parvis rotundatis basi pallidioribus, perichætialibus inferne latioribus superne angustioribus, theca in pedunculo elongato breviter ovali oblonga sexplicata sublævi, calyptra generis.

Polytrichum gymnophyllum, ex parte, *Wils. in Sched.*

Hab. In Ceylon, ad Hantani, *Gardner* (No. 1223).

P. gymnophyllo gracilius, foliis, in speciminibus paucis mihi obviis, compressis, margine incrassato a reliquis speciebus Indicis statim dignoscitur.

13. P. RUFISETUM (Polytrichum, *Wils. in Sched.*). Caule elongato gracili dichotomo fastigiatimque ramoso, foliis patulis e basi lata

subquadrata cellulis inferne elongatis angustis subito angustatis lanceolatis lamellis obtectis apicem versus parce serratis, perichætialibus conformibus, theca in pedunculo longo aurantiaco ovali-cylindrica erecta inclinatave, operculo breviter conico rostro brevi, calyptra pilosa thecam totam obtegente, flore masculo foliis perigonialibus hastato-ovatis breviter acuminatis.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 1193, 1194, 1204, 1235).

P. Teysmanni (Dozy et Molk.) valde affine, sed foliis a basi quadrata subito angustatis angustioribus recedit.

14. P. FUSCATUM (*Mitten*). Caule elongato simpliciusculo, foliis siccitate incurvis subcrispatis humidis patulis e basi subquadrata, cellulis infimis parvis firmis oblongis cæteris rotundis paululum angustatis lanceolatis acutis lamellis obtectis margine e medio ad apicem dorsoque argute serratis, perichætialibus externis conformibus internis angustioribus, theca in pedunculo unciali erecta inclinatave ovali-cylindracea, operculo hemisphærico brevirostrato, calyptra thecam totam obtegente.

P. cirrhatum, *Wils. in Sched.*

Hab. In Himalayæ reg. temp., Nepal, *Wallich*! Sikkim, *J. D. Hooker*! (No. 1225, 1233, 1242). In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*! (No. 1203, 1230). Kumaon, *Strachey et Winterbottom*!

P. cirrhato dimidio minus, foliis fuscis basi dilatata angustiore integerrima.

15. P. FASTIGIATUM (*Mitten*). Caule elongato simplici dichotome fastigiatimque ramosove, foliis siccitate incurvis cirrhatis a basi latiore ovata erecta, cellulis parvis elongatis parallelogrammaticis patulis divergentibusque longe lanceolatis lamellis brevibus densis obtectis, margine a basi infima ad apicem dorsoque superne serratis, perichætialibus basi longiore convolutaceis, theca in pedunculo brevi semunciali ovali-cylindrica erecta inclinatave, operculo convexo breviter rostrato.

Polytrichum convolutum, *Wils. in Sched.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker*! (No. 1182, 1183, 1202, 1240). In mont. Khasian., ad Kollong, *J. D. Hooker et T. Thomson.*

Species *P. cirrhato* et *P. macrophyllo* (Dozy et Molk.) intermedia. A *P. convoluto* Americæ meridionalis, icone Schwægricheniano satis bene illustrato, foliis angustioribus opacioribus rigidioribus et a basi infima serratis recedens; a *P. cirrhato*, ad quod serratione foliorum accedit, foliis latioribus tota superficie lamellis brevissimis obscura, siccitate magis crispatis crassioribus, theca in pedunculo breviore; a *P. macrophyllo*, statura affiniore, foliis magis cirrhatis obscuris et e basi serratis, diversa.

4. Polytrichum, *Dill.*

* *Cephalotrichum*, B. & S.

1. P. perichætiale, *Mont.*

Hab. In mont. Nilghiri, *Perrottet*! *Schmid*! In Himalayæ reg. temp. et alp., Sikkim, *J. D. Hooker*! (No. 1213, 1239, 1251, 1251 *b*). Simla, *T. Thomson*! (No. 1262). Nepal, *Wallich*!

2. P. Thomsoni (*Mitten*). Caule breviusculo, foliis strictissimis patulis, comalibus divergentibus, e basi orbiculari subquadratave latiore subpellucida cellulis brevibus areolata lanceolatis apice in cuspidem piliformem fuscam acuminatis, lamellis brevibus obtectis, marginibus incurvis dentibus spiniformibus paucis serratis, perichætialibus erectioribus superne angustatis, theca in pedunculo unciali flexuoso fusco ovali, peristomio et calyptra *P. perichætialis.*

P. pungens, *Wils. in Sched.*

Hab. In Himalayæ boreali-occident. reg. temp., Simla, *T. Thomson*! (No. 1231).

P. perichætiali simillimum, sed foliis basi brevioribus superne spinoso-dentatis et cuspidiferis facile distinctu.

3. P. tortipes (*Wils. in Sched.*). Caule breviusculo, foliis siccitate curvatis tortisque humidis erectis e basi lata oblongo-ovata inferne cellulis laxis pellucidis elongatis parallelogrammaticis areolata lanceolatis lamellis obtectis marginibus incurvis dentibus remotis serratis apice in mucronem acuminatis, perichætialibus convolutis superne angustatis, theca in pedunculo rubro-fusco flexuoso suberecta inclinatave ovali oblonga inæquali, operculo convexo rostro brevi curvato, calyptra thecam totam obtegente.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 1184, 1210).

A *P. perichætiali*, foliis siccitate curvatis dentatis, statim distinguitur; a *P. Thomsoni*, foliis longioribus basi multo laxius areolatis, et theca inæquali.

** *Eupolytrichum.*

4. P. densifolium (*Wils. in Sched.*). Caule breviusculo unciali, foliis densiusculis siccitate erectis appressis, comalibus parum curvatis humidis patulis e basi subquadrata latiore superne dilatata tenuiter hyalino-marginata cellulis oblongis pellucidis areolata lanceolatis sensim acutis lamellis obtectis margine ubique parvo spatio a lamellis discreto dorsoque apice serratis, perichætialibus basi longioribus convolutaceis superne angustioribus, theca in pedunculo longiusculo (biunciali) ætate horizontali subcubica.

Hab. In Himalayæ orient. reg. temp. et alp., Sikkim, *J. D. Hooker* (No. 1198, 1205).

Formis communibus *P. juniperini P. gracilisve* habitu, statura coloreque simile, sed foliis margine non inflexis, et perichætialibus a caulinis non adeo diversiformibus.

5. P. XANTHOPILUM (*Wils. in Sched.*). Caule elongato, foliis siccitate appressis curvatis falcatis, humidis patentibus, e basi subquadrata cellulis elongatis angustissimis pellucidis areolata lanceolatis apice latiusculis lamellis obtectis margine apiceque dorso dense serratis, perichætialibus basi longiusculis convolutaceis, theca in pedunculo elongato ætate horizontali tetragona suboblonga inter basin et apophysin contracta. *Calyptra* juvenilis pallide flava.

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 1191).

Pogonato urnigero, var. *crasso*, simile, sed theca tetragona.

5. LYELLIA, *R. Br.*

1. L. crispa, *Hook.* (Polytrichum, No. 6, *Griff. Not.* p. 390.)

Hab. In Himalayæ centralis et orient. reg. temp., Nepal, *Gardner, Wallich*! *J. D. Hooker* (No. 1180). Sikkim, *J. D. Hooker* (No. 1181). In collibus Bhotan et Abor, *Griffith*!

2. L. bifurcata, *Bél. Voy. dans l'Ind. Orient., Bot.*, II. *Crypt.* p. 99.

Hab. In peninsula Indiæ orient., in locis altioribus circa locum Gâtes dictum, *Bélanger* (sterilis).

Forsan species *Pogonati* quædam.

S. 2. HETERODICTYA. *Foliorum cellulæ dimorphæ.*

§ I. SPHAGNACEÆ.

1. SPHAGNUM, *Dill.*

1. S. cymbifolium, *Dill.*

Hab. In Himalayæ orient. reg. temp., Sikkim, *J. D. Hooker* (No. 1283, 1287, 1289, 1292).

2. S. cuspidatum, *Ehrh.*

Hab. In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 1284, 1286, 1290, 1291).

3. S. acutifolium, *Ehrh.* (S. fimbriatum, *Wils. l. c.* p. 290.)

Hab. In Nepal orient. *J. D. Hooker*! (No. 1285).

4. S. Gedeanum, *Dozy et Molk. Bryol. Javan.* t. 19.

Hab. In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson*!

5. S. Junghuhnianum, *Dozy et Molk. Bryol. Javan.* t. 18. (S. fimbriatum, var., *Wils. in Sched.*)

Hab. In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 1293).

6. S. KHASIANUM (*Mitten*). *S. subsecundo* simillimum, sed foliis cau-

linis cellulis omnibus repletis tenui-marginatis, caule pallido, cortice ex unica serie cellularum composito.

S. contortum, var., *Wils. l. c.* p. 290.—S. obtusifolium, *Griff. Not.* p. 386; *Icon. Plant. Asiat.* t. 76. f. 1?

Hab. In mont. Khasian. reg. temp., *J. D. Hooker et T. Thomson* (No. 1282). Ad Moosmai, *Griffith*?

Species, ut videtur, a *S. subsecundo* diversa, sed, ob descriptiones imperfectas, vix determinari potest.

ADDENDA ET CORRIGENDA.

P. 5, *pro* ORTHOTRICHUM *in* BRYACEÆ *lege* ORTHODONTIUM.
,, ,, MIELICHOFERIA *l.* MIELICHHOFERIA.
,, ,, CHARTOMITRIUM *l.* CHÆTOMITRIUM.
6 ,, CYATHOPTERYGIUM *l.* CYATHOPHORUM.
9, *inter* L. DIVARICATUM *et* L. GRIFFITHII *insere*—

L. SPIRALE (*Mitten*). Dioicum, *L. crispo* persimile, foliis perichætialibus e basi subquadrata vaginante cellulis omnibus elongatis angustis areolata subulatis, theca in pedunculo sicco recto humido superne spiraliter flexuoso forma et plicatione et operculo etiam peristomio *L. crispi*.

Hab. In Himalayæ orient. reg. temp., *J. D. Hooker*; inter cæspitem *L. tortilis* plantulas paucas carpsi.

L. crispo (Dicranum, *Hedw.*) primo visu statu exsiccato omnino simile; foliis perichætialibus autem basi latiore paululum superne dilatatis cellulis omnibus angustis non laxis prosenchymaticis et pedunculi flexura diversum.

P. 38, *pro* D. LIMBATUS *l.* D. SUBLIMBATUS.
,, *post* D. JAVANICUS (Barbula, *l. Dzy. et Molk.*
63, *P. seriata* inter species Indicas sedem nullam habet, et descriptio ejus pro parte observationis præcedentis legenda est.
89, *pro* M. HOOKERI *l.* M. SPARSUM.
101, *in descriptione thecæ* S. TUBERCULATI, *pro* subtuberculatove *lege* subtuberculato.
102, in *Hab. S. brachypelmæ* post nomen "*Wallich*" insere, !
108, in descriptione *S. caliginosi* et in notula ad *S. Schwægricheni*, etiam in descriptione *S. Griffithii*, loco *S. Hookeri* lege *S. rubicundi*.
112, *pro* S. LANYTRICHUS *lege* S. TANYTRICHUS.

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